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Maintenance of Motive Power On New England Railways

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Layout of the shop and arrangement of the equipment—How materials are handled—Journals and driving boxes—Two methods of turning crown brasses—Casting hub liners—A driving-box chuck

THE New York, New Haven & Hartford Railroad serves the southern part of the New England territory, covering the States of Connecticut and Rhode Island as well as a large part of Massachusetts, and having outlets to New York City and to the eastern part of New York State at Poughkeepsie. Its main shops are located at Readville, Mass., and here all general and classified repairs are handled.

The locomotive shop is 300 ft. wide by 1,280 ft. long, with a gallery 50 ft. in width extending nearly the whole length at one side. About one-half of the main floor is given over to the erecting department and is served by five bridge cranes ranging from 10 to 50 tons capacity. The heavier machine tools occupy the remaining portion of the main floor not covered by the gallery, and this bay is also served by bridge cranes. Jib cranes and trolleys with air and electric hoists serve the smaller equipment under the gallery and on the gallery itself.

Disassembly for Repair

Locomotives to be overhauled are run in at one end of the building on a track that extends down the center of the bay. After stripping them of their gear, two of the large cranes lift them from their wheels and deposit them upon blocking at convenient points on either side of the central track. The various parts are sent to their respective departments to be repaired, and when such repairs are completed they are again brought together at some point along the central track near the other end of the building.

Meanwhile repairs to boiler and frame as needed have been going on at the station where the engine is berthed, and when everything is ready for assembling, the engine is again lifted by the two cranes, transported the length of the shop and deposited upon its wheels, ready to be run out to the yard or testing shed. The locations of the various departments have been arranged so that the work will be progressive and unnecessary transportation of parts avoided.

The potash tanks for cleaning the parts are in a separate building alongside the locomotive shops and connected to it by tracks and concrete runways, over which may be run the small push cars or the storage battery trucks that complete the transportation system of the shop. As the stripping progresses the parts are loaded on the cars or trucks, or into steel baskets as the size may dictate, and are carried to the wash room where they are picked up by a bridge crane that serves this department and deposited in the tanks.

Cranes for Each Group

Adjacent to the stripping pits are the wheel and axle lathes, quartering machines, hydraulic forcing presses and other machines incident to the repair of driving wheels and axles. All of this machinery is covered by the 10- and 50-ton cranes.

Under the gallery, opposite the wheel and axle department, are the machines required to handle all the work on driving boxes, crown brasses, etc., including turning lathes, forcing press to set the crown brass into the driving box, planers, slotters, and an oil-fired furnace to melt the brass.

One of the driving wheel lathes is shown in Fig. 1. It is a Niles-Bement-Pond of the latest type, and is fitted with air clamps to hold the turning tools. Forming tools, one of which may be seen on the tool slide, are single pieces of Rex AA steel, bolted to forged holders. The holder for the roughing tool, shown in Fig. 2, is a steel casting having in one end a pocket just big enough and deep enough to hold the toolbit, which is not fastened in the holder. This type of holder is an experiment that is working out very well. The tool cannot get out of the holder while the work is in front of it, and there is apparently no tendency to chatter. The bit can be removed and replaced with a minimum of trouble.

There are two of these lathes in constant service, and in the same line is an older lathe that has been partly reconstructed and speeded up so that it may handle all axle work that is done with the wheels in place.

Opposite to the wheel lathes are two boring mills, one of which may be seen in Fig. 3, to bore new tires and turn wheel centers. These machines are kept fairly busy on this work most of the time, but are available for other work of large diameter when necessary.

Tires are removed and reset in a separate building adjoining the locomotive shop and connected to it by tracks. A bridge crane in this building provides a means of handling the heavy parts. Fig. 4 shows a pair of wheels on the horses to remove one of the tires.

Heat is applied to remove a tire by means of adjustable torches mounted on floor stands, but removable for use in other positions if needed. A pit furnace is provided to heat a tire to be shrunk onto a wheel center. By having this work taken care of in a separate building the presence on the erecting floor of fires, with their attendant nuisances of smoke, gas and hot metal, is avoided.

A set of new driving boxes on the planer is shown in Fig. 5. A box-sectioned anglepiece in the center of the planer table provides means to hold twelve boxes at once, and the two heads of the planer enable the operator to carry on the work on two rows of the boxes simultaneously.

A lathe that has been fitted up especially to turn crown brasses may be seen in Fig. 6. The air cylinder *A* is permanently attached to the rear end of the spindle of the lathe and revolves with it. The piston rod extends through the hollow spindle and terminates in the disk *B*, which is fastened to the end of the rod. The rod is splined to the spindle so that both parts must rotate together. The disk *C* is screwed to the nose of the lathe spindle.

Air is admitted from the shop mains through a packed, rotating joint in the outer head, and through passages in the wall of the cylinder it enters behind the piston, causing the disk *B* to be drawn toward its mate. Pressure is applied and released by a four-way valve, the handle of which is located on the headstock of the lathe convenient to the operator's left hand.

Fig. 1—The driving wheel lathe

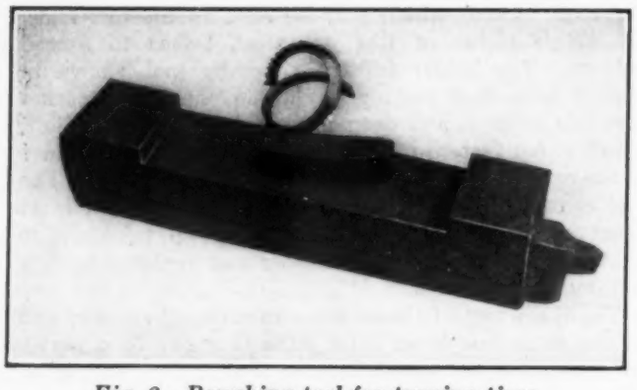

Fig. 2—Roughing tool for turning tires

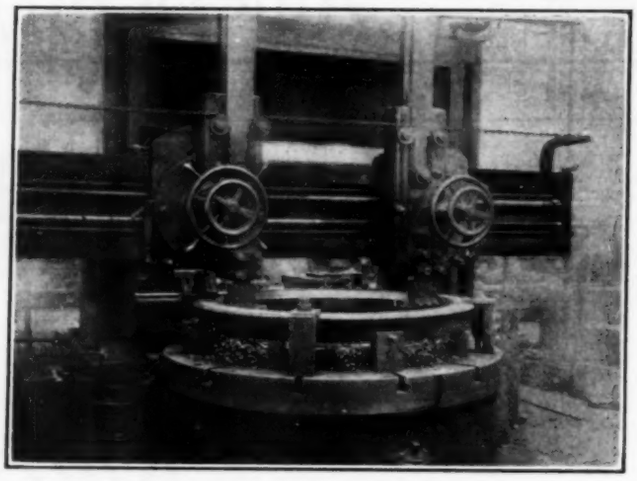

Fig. 3—Boring a new tire

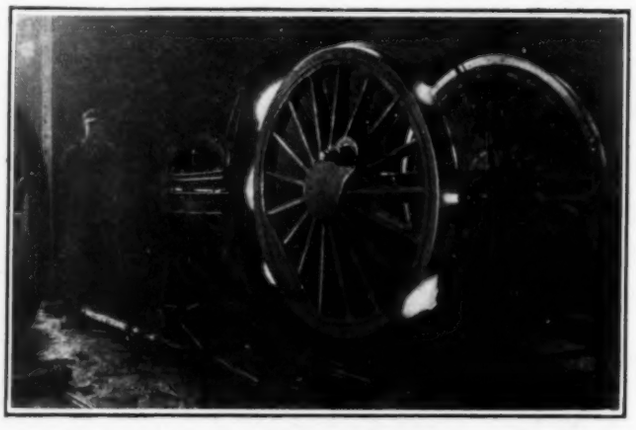

Fig. 4—Removing a tire

Holes in the face of each disk near the periphery are fitted with small shouldered plugs of hardened steel having the larger ends checkered to bite into the brass. The plugs are not fastened in, being merely pushed into the holes until their shoulders bear against the face of the disk so that their positions may be changed at will of the operator.

To set up the lathe for turning a brass, a board is laid across the front and rear wings of the carriage to the left of the cross-slide, a brass is laid open side up on the board and hooked under the rod to which the outer disk is attached. The operator has a number of wedge-shaped shims, one for each size of brass to be turned, and by placing the proper shim under it the brass is centered almost automatically. A pair of inside calipers is used between the rod and the lips of the brass to test its position,

Air is then admitted to the cylinder, causing the outer disk to move toward the headstock and clamp the brass between it and its mate. The tail center of the lathe is brought up to bear in the center hole of the outer disk to furnish additional support made necessary by the otherwise long overhang; it has nothing to do with holding the brass.

Fig. 5—Planing new driving boxes

While the rig above described provides an exceptionally quick method of swinging up a brass to be turned, the width of brass that it can handle is limited by the stroke of the piston. The main brasses of many engines are too wide to come within the range of this device, and their number is not yet sufficient to warrant the construction of an additional machine. Wide brasses are therefore at present handled on a vertical turret machine. Fig. 7 shows such a brass, 22 in. wide, mounted on the table of the vertical machine and held by a nut and washer on the top of the central stud, which is a part of the fixture used for this purpose.

There are two methods employed to machine the interior of a driving box to make the seat for the crown brass. The first, and probably the most commonly practiced, is to lay the box on its side on the rotary table of a slotting machine, center it with the axis of rotation of the table, and plane it to size and shape by feeding the table around. For individual boxes the width of which is not too great for the range of a standard slotting machine this method is used in this department. The second method is far more rapid and satisfactory when there are a number of boxes to be machined, and it is also used of necessity to machine single wide boxes.

The device is made to go in the tool slide of a planer. A shank of suitable size to be held by the tool clamps has at its lower end a circular boss which forms the seat and axis of a rotatable disk. On the face of the disk, near the periphery, is a small toolpost. The periphery of the disk is cut as a worm wheel and it is rotated by a worm on the lower end of a vertical shaft that extends up along the tool slide and terminates in a ratchet and pawl that derives its movement from the regular feed motion of the planer.

With a row of boxes set up on the planer table, open end up and with the axes of the boxes parallel with the line of travel of the table, the device is placed in the tool slide and the axis of rotation of the disk brought to coincide with the center line of the boxes. This is not in the least difficult to do, as the cross and vertical movements of the slide are available for the purpose.

When the device is properly set, the vertical slide is clamped against further movement and a stop is placed on the cross rail of the planer to bear against the saddle. Rotating the disk so that the small toolpost is at one side and about level with the center of rotation, the cutting tool is introduced and set to the radius of the roughing cut to be taken.

By means of the cross-screw the saddle of the planer is then drawn away from the stop by a distance sufficient to allow the point of the tool to clear the work, and the planer table set in motion. Now by feeding the saddle back against its stop intermittently as the table reverses the tool is fed in to its proper cutting depth. All that remains is to engage the rotary feed and allow the tool to sweep around the radius to the opposite side of the box.

This is not all done in one operation by any means.

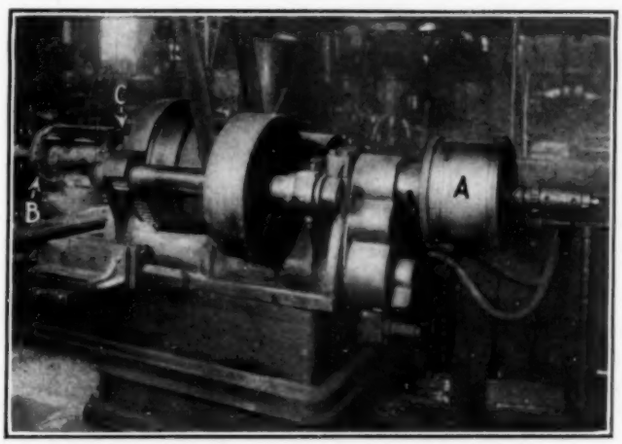

Fig. 6—Air-operated clamping device to hold crown brass for turning

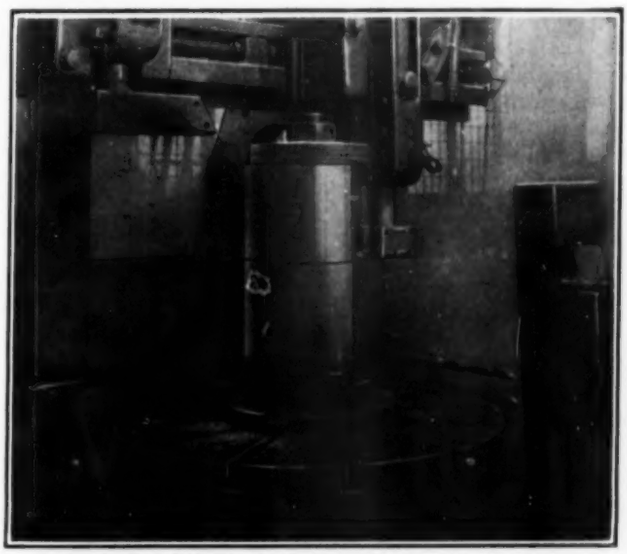

Fig. 7—Turning wide brasses on vertical turret machine

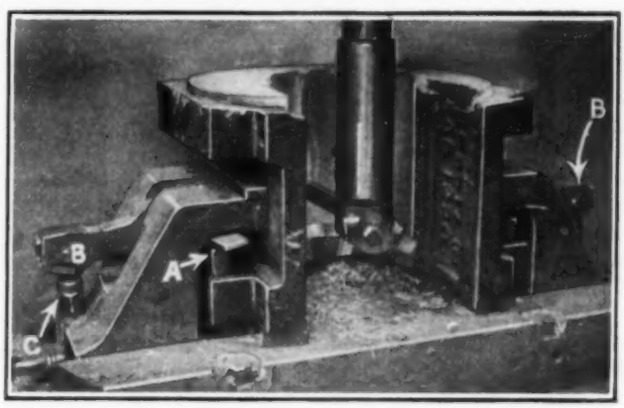

Fig. 8—Self-centering chuck to hold driving boxes

It may require several cuts—depending somewhat upon the condition of the steel castings—and there is always considerable digging to be done in the corners; but for machining a new set of boxes this rig is far more efficient than the method of planing them out individually on a slotting machine.

A self-centering chuck to hold driving boxes for boring and facing is shown in Fig. 8. Though there are similar chucks on the market, this one was built in the toolroom of the shops where it is used at a time when such devices were far from common. As a time-saver over the old familiar method of wedging a strip of wood between the lips of the brass, fixing a piece of tin somewhere near the middle of the strip and marking off the center exactly midway between the shoe-and-wedge faces of the box by the aid of squares, parallels and other cob-house arrangements, it is invaluable.

After placing the box in the chuck and bringing up the jaws to center it, but before finally tightening them, pieces of blocking are introduced as at *A* between the flanges of the box and the inner end of the small levers *B*. Now by setting up the sleeve-nuts on the small jackbolts *C* the box is forced to a seat on the base of the chuck. The main jaws may now be tightened by means of a wrench on the right- and left-hand screw of the chuck.

The wear-plate, hub-plate, hub-liner, driving-box-facing, or whatever the alias by which the piece may be known to railroad men—and it has more names than any other single part of a locomotive—is attached to the face of the driving box by various means, the most common of which is probably by casting it in place. At any rate this is the practice of the Readville shops.

One of the most common methods of anchoring the brass casting to the box is to sink a dovetailed groove into the face of the latter, often concentric with the

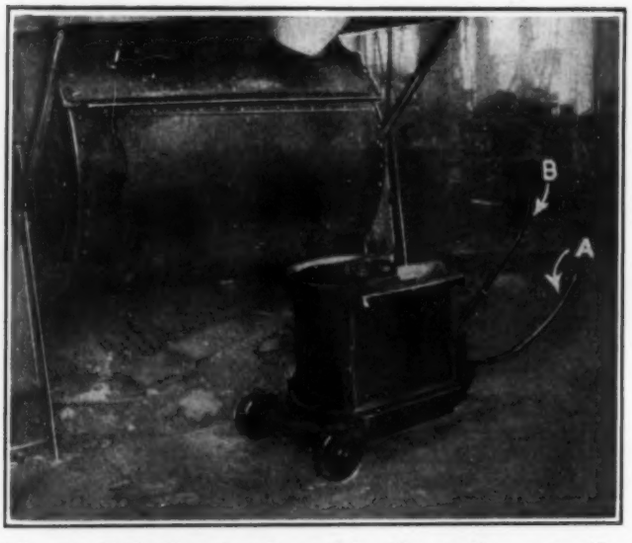

Fig. 9—Swiveling truck used in the casting operation

center of the brass but sometimes not, and drill several blind holes in the bottom of the groove into which the molten brass may run and thus provide studs to resist the wringing action caused by the friction of the hub of the driving wheel.

Before pouring the molten brass in the prepared driving box, the box is heated to a temperature of about 400 deg. in order to counteract to some extent the tendency of the molten brass in cooling to shrink away from the walls of the dovetailed groove.

A box is prepared for pouring by placing a horse-shoe shaped forging upon the face of the box to confine the molten metal on the outside and damming the open end with a mixture of shredded asbestos and clay. The width of the crown brass is such that it extends an inch or so above the face of the box and prevents the molten metal from escaping toward the center. The

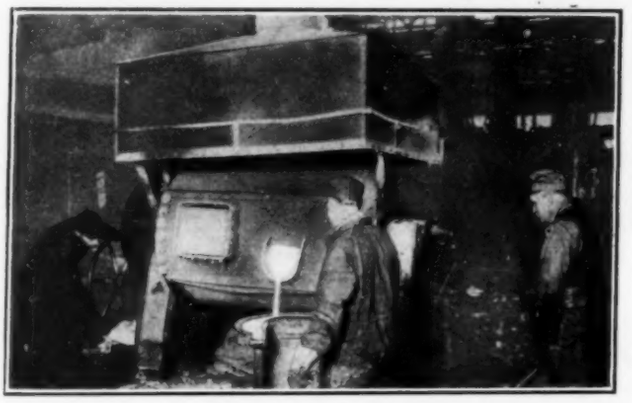

Fig. 10—Pouring the facing on a driving box

crown brass itself thus becomes a part of the wearing surface when the cast is finally faced off.

The equipment for melting and pouring the brass facings on the driving boxes is very good. A rotary, oil-fired furnace, swinging upon trunnions in a horizontal plane and operated by a large handwheel and train of gearing, is used not only to melt the brass but to pour it, thus doing away with the necessity for ladles and their attendant troubles. The furnace is located under a hood, as may be seen in Fig. 9, by which all smoke, gas and fumes are carried away.

A box, prepared for the cast, may also be seen in this illustration. The three-wheeled iron truck on which the box rests has a circular platform that is mounted on a vertical stud so that the box may be turned completely around on its own center without moving the truck. The handle *A* is the handle by which the truck is drawn about. The handle *B* is used to rotate the platform and box.

The furnace at the moment of making a cast is shown in Fig. 10. The truck, with a box upon it, is rolled into a position that will enable the furnace man to deliver the molten brass directly from the pouring lip to the place where it is wanted. The truck is not again moved until the box is ready to be taken away. While the brass is running into the mold prepared on top of the box, the caster is slowly turning the box about its own center by means of the handle *B*, and the brass is thus delivered evenly to all parts. There is little wastage, as there is no need of "piling it up" in order to get the molten brass to run to the extreme corners of the mold.

The fore-and-aft dimension of a driving box—the distance between the shoe-and-wedge faces—is always made to a definite figure in increments of $\frac{1}{8}$ in.; that is, when a box has to be redressed on these faces the new dimension is always made to some $\frac{1}{8}$ division of the measuring scale. This practice will be considered more fully in a later article under the head of shoes and wedges. When a box has been replaned to its limit, if it is otherwise in good condition, the shoe-and-wedge faces are built up either by casting brass upon them in very much the same manner that the facings are cast, or else by welding steel plates to them.

Arc Welding Practice and Inspection

By A. M. Candy
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The field of arc welding in the metal industries— Importance of standardized method and training — Tests of arc-deposited metal — Inspection methods

IN VIEW of the rapid spread of the use of the arc welding process during the past five years it may be stated without fear of contradiction that there are practically no steel metal working plants that cannot make economical use of at least one piece of arc welding equipment. It is only in recent years, however, that the full value of arc welding in many manufacturing processes has been recognized. Formerly the arc welding process was looked upon simply as a repair method to be used only in case all other methods failed. Now, however, it is becoming more and more evident that arc welding is not only a valuable repair method but, in many cases, an efficient production process. This is due partly to improvements in arc welding equipment and partly to the development of accurate methods of inspecting welds.

The process of arc welding is subject to standardization and wherever it is used to an appreciable extent, a welding organization should be established. Definite arrangements and a training course for developing new welders should be provided. A welding supervisor should be in general charge of all welding work and should be a person who understands arc welding thoroughly and who can determine by simple inspection methods whether good welding is being done by the operators.

In all but a relatively few plants and shops the process of arc welding is carried on in a manner that

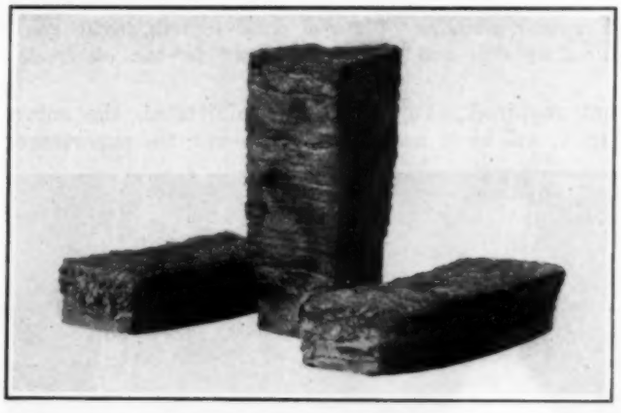


Fig. 1—Test blocks of deposited metal, approximately 14 lb. each, for use in determining ductility and strength of arc-deposited metal

would not be tolerated for any other process. In well-organized mechanical shops all production and repair work is handled in an orderly and definitely fixed manner and facilities are provided for the training of apprentices. Designs are largely standardized and work is carried out according to specific instructions, from drawings prepared by competent engineers. The work is supervised from start to finish by foremen and the component parts and finished product are carefully examined by trained inspectors.

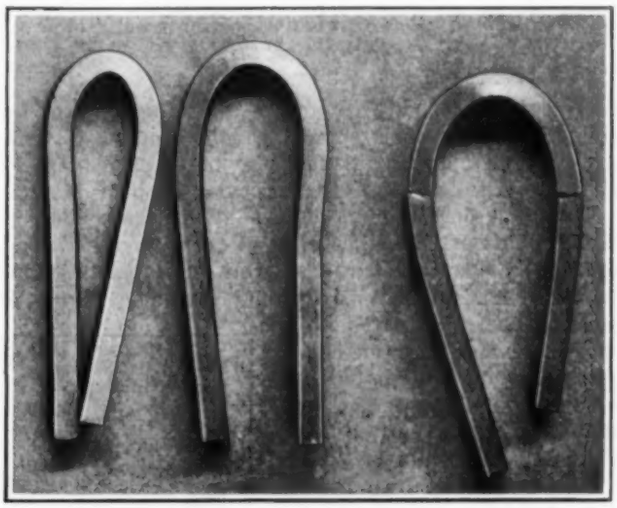


Fig. 2—Appearance of bending test specimens taken from blocks shown in Fig. 1, showing inherent ductility of arc-deposited metal

To obtain the best results, arc welding should be carried on in the same systematic manner. As comprehensive an organization as required for a given shop should be built up and maintained, and welding operations should be standardized wherever possible.

Where welding is to be used in tank fabrication, on building construction, or other similar work, the parts to be welded should be designed to facilitate the welding operation, and to conserve plate and angle material which arc welding makes possible. The drawings should specify definitely the location and amount of weld metal to be deposited, the type, grade and size of welding wire to be used and the approximate current value required.

To obtain the best results from such an organization a welding manual should be prepared. The first portion of it should deal with some of the fundamentals of welding, such as arc characteristics and method of metal transfer through the arc; principles involved in obtaining good fusion; testing and inspection of arc metal and arc-welded joints; welding cast iron; uses of the metal electrode and carbon electrode in welding;

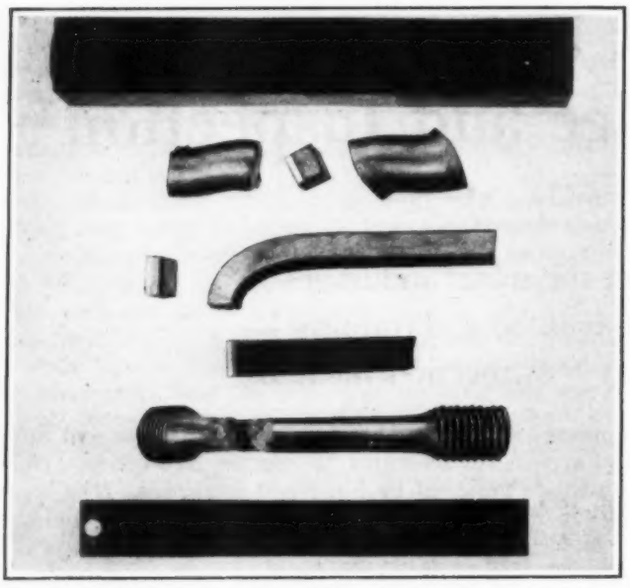


Fig. 3—How pieces of arc-deposited metal taken from samples in Fig. 1, stood up under tensile and compression tests

carbon-electrode cutting and a training course for welders. The second portion should deal with standardized and approved methods to be employed on the specific work done in each particular shop or plant.

It is not desirable to discuss all of these subjects fully in this article, since most of them have been covered in various publications. Our principal object is to give sufficient data to stimulate those in charge of welding operations to make a more intensive study of existing literature and to encourage plant operators, not now doing welding, to investigate its possibilities in their work.

In the past many superintendents have had experience with arc welds made with inferior materials and equipment and without observing the practices that are now generally recognized as the best. The result has been that those individuals have received the impression that arc deposited metal is very brittle and will not withstand bending, alternating stresses or shocks. To counteract these erroneous impressions many tests have been conducted to show just what may be expected of good welds. Fig 1 shows three loaves of arc deposited metal, weighing about 14 lb. each, which were built up on small pieces of ½-in. boiler plate plainly visible in the cut. In each case the boiler plate material was cut away and test samples were cut out of the solid arc-deposited metal. Fig. 2 and Fig. 3 show some of these samples that illustrate the ductility of the arc deposited metal. Table I shows the physical properties of arc-deposited metal turned into test pieces as shown at the top of Fig. 3.

Table I—Physical Properties of Arc-Deposited Metal

Lb. Per Sq.In.			Per Cent	
Ultimate Tensile	Yield Point	Elastic Limit	Elongation in 2 Inches	Reduction of Area
56,100	33,400	27,500	18.1	30.8
56,075	35,875	29,000	16.0	23.4
51,375	29,050	24,000	14.1	18.8
58,825	44,000	34,500	9.2	19.9
54,650	35,000	29,000	6.5	13.4

Table II—Results of Compression Tests

Load in Lb. per Sq.In. at 10 per Cent Compression	Elastic Limit Lb. per Sq.In.
63,250	32,000
60,750	30,700
60,700	30,400

Compression samples shown at bottom of Fig. 3 gave results shown in Table II.

Results such as these can be obtained by any good welder who is trained to observe the relatively simple principles involved in obtaining good fusion. It goes almost without saying that good welding wire must be used. The wire should conform with the specifications of the American Welding Society and must pass smoothly through the arc, while the end of the wire should show a slight globular formation when the arc is broken. This globule should be smooth and solid as shown by Fig. 4. Any wire that shows a large, rough, hollow globule, as in Fig. 5, should not be used.

Under all conditions the operator must hold a short arc, as in Fig. 6. A short arc will produce a deposit as shown in Fig. 7 whereas a long arc will produce a very undesirable deposit as illustrated in Fig. 8.

To obtain good fusion it is of course necessary to use a current value sufficiently high to properly fuse the work being welded, while the size of the welding wire must be selected to work correctly with the current required. To assist the uninitiated, the curve, Fig. 9, will be of assistance. However, the experienced

Fig. 4—Solid sections and regular globules obtained with a ⅛-in. drill rod.
Fig. 5—Cavities are produced by slag and gases contained in the electrode

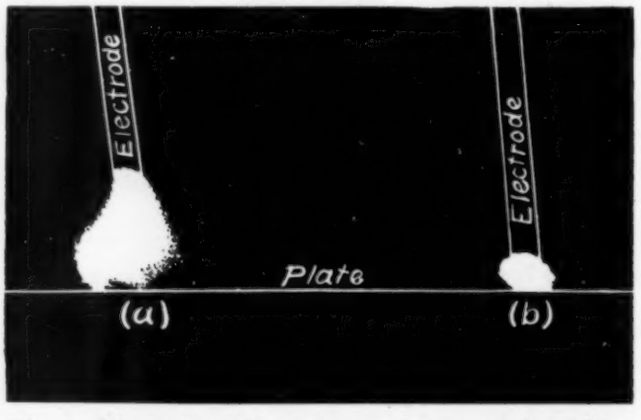


Fig. 6—Illustrating the exposure of new metal resulting on holding a long arc, and the protection gained from the enveloping gases from a short on-

welder needs no tables or curves, because he can readily determine if conditions are correct by inspecting the deposited metal and examining the depth of the crater at the point where the arc is broken, as shown at the left end of Fig. 7. The depth of the crater is almost

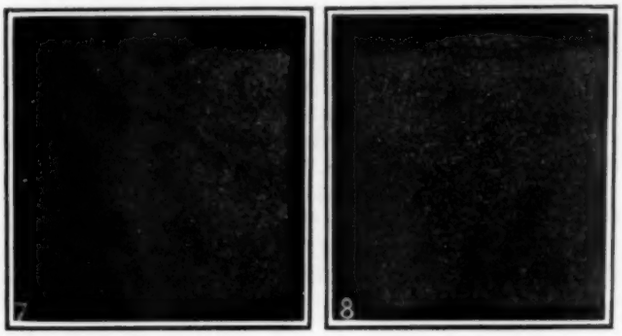


Fig. 7—Desirable round and smooth deposit of metal obtained by using a short arc. Fig. 8—Rough, uneven, undesirable deposit resulting with the use of too long an arc

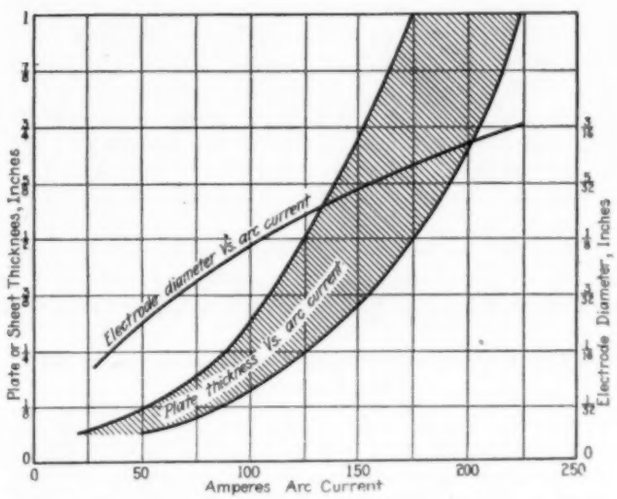


Fig. 9—In this curve, plate thickness and electrode diameter are plotted against the current. In case of a plate thickness of ⅜ in., a current of from 110 to 155 amp. would be used. If using a ⅛-in. electrode, a current of 105 amp. would give best results

exactly equal to the depth of the fusion being obtained in the work, and the smoothness of the metal bead and the crater surface is a direct indication of the quality of the welding wire and the deposited metal. By these observations and occasionally watching welders at work an experienced person can inspect welded work accurately and determine its value. The plants that are handling their arc welding work by the above methods are obtaining eminently satisfactory results.

Here's a thought: Find jobs for some of your men in other plants. Not the men you don't especially want, but some of the best. Help a good man into a foremanship that way. Or help a foreman to become a superintendent. If your product is as good as it should be, the man you help will be loyal to it and will be a booster for it on his new job.

Seen and Heard—Discussion

By R. L. Irvine

Referring to the article by John R. Godfrey, under the title given above and published on page 384, Vol. 63, of the *American Machinist*, it appears that Mr. Godfrey has not grasped the ideas of the requirement, quoted by him, of the Navy specifications for chisel blanks. The requirement is a common one in Navy specifications. Its purpose is not to limit the bidders to persons or firms that have supplied satisfactory material to the Navy, and the analogy to the "tight boots" does not follow.

The purpose, as I understand it, is to require prospective bidders to submit samples of their product to the Navy Department for testing and placing on the acceptable list of articles, if satisfactory, provided such materials have not already been tested by the Navy Department and listed as acceptable. This is not favoritism in any sense, but does serve the Navy Department and reputable dealers to advantage, in that it establishes reliable sources of supply and reduces the delays, investigations, and other complications that would occur if such restrictions were not followed in procuring bids.

The Navy Department is a big institution using vast quantities of materials, tools, etc., of almost every description. If any dealer is sufficiently interested to seriously desire Navy Department business, he should be willing to establish to the satisfaction of the Navy Department the quality, reliability and suitability for Navy purposes of his products.

As regards the efficiency or inefficiency of the Navy purchasing system and personnel, let it suffice to state that the system is to a large extent controlled by laws designed to provide for fair, open competition, eliminating any possibility of favoritism, graft or similar irregularities. With the restrictions imposed, the system developed has not only stood the tests of time, but has been commented upon, I believe, by disinterested experts after the test of war conditions, as being the most perfect and efficient purchasing system under the Government.

In closing, I might recommend to the author of the article referred to, an investigation and study of Navy methods if he is interested as he apparently should be. Such an investigation might result in benefit to himself and also to the Navy by changing his attitude from that of superficial destructive criticism to that of an interested loyal supporter of one of the most vital departments for national defense.

To Establish an American Standard

The Society of Automotive Engineers has asked that it be designated by the American Engineering Standards Committee as one of the sponsors for the Sectional Committee on Pins and Washers that is being organized under the procedure of the American Engineering Standards Committee by the American Society of Mechanical Engineers. The task of the committee is to establish an American standard for various types of pins and washers used in mechanical constructions. There are at present three S.A.E. standards in the S.A.E. Handbook for these parts, which it may be expected will be considered by the sectional committee in formulating a general American standard.

Recommended Practice for the Carburizing and Heat-Treatment of Camshafts

THE American Society for Steel Treating has issued a bulletin covering the following tentative, recommended practice to be followed in the carburizing and heat-treatment of camshafts. While the practice has been approved by the Recommended Practice Committee of the Society, it will remain tentative until adopted by this Committee and the Board of Directors of the Society.

The steels listed in Table I may be used for camshafts, and this recommended practice is not applicable to steels having any other chemical composition.

Table I—Chemical Composition

Steels	C	Mn	P. max	S. max	Ni.
S.A.E. 1015	0.10–0.20	0.30–0.60	0.045	0.050	.....
S.A.E. 1020**	0.15–0.25	0.30–0.60	0.045	0.050	.....
S.A.E. 2320	0.15–0.25	0.50–0.80	0.040	0.045	3.25–3.75
½ per cent NI	0.10–0.20	0.30–0.60	0.045	0.050	0.50–0.75
S.A.E. 2512	0.17 Max	0.30–0.60	0.040	0.045	4.50–5.25
S.A.E. 3120[1]	0.15–0.25	0.30–0.60	0.040	0.045	1.00–1.50
Ni-Mo[2]	0.10–0.20	0.30–0.50	0.040	0.045	1.25–1.75
S.A.E. 6120[3]	0.15–0.25	0.50–0.80	0.040	0.040	.....
Cr-V**	0.10–0.15[4]	0.30–0.50	0.040	0.040	.....

**These steels are the ones most commonly used for camshafts.
[1]The chromium content for this steel is 0.45 to 0.75 per cent.
[2]The molybdenum content for this steel is 0.20 to 0.30 per cent.
[3]The chromium content for this steel is 0.80 to 1.10 per cent and the vanadium content is 0.15 to 0.20 per cent.
[4]The chromium content for this steel is 0.25 to 0.40 per cent and the vanadium content is 0.15 to 0.20 per cent.

For annealing and heat-treating (after forging and before machining) the S. A. E. steels 1015, 1020, 2320, 3120, 6120, and the 0.50 per cent nickel, nickel-molybdenum, and the chromium-vanadium steels, place the steel in the furnace so as to expose the maximum surface area. Heat slowly and uniformly to a temperature of from 1,600 to 1,650 deg. F., and cool at a rate to give the desired machinability.

For annealing the 5 per cent nickel steel (S. A. E. 2512), place in furnace so as to expose the maximum surface area. Heat slowly and uniformly to 1,600 deg. F., and hold at this temperature for about one hour. Cool slowly in furnace to 800 deg. F., and then cool in air.

Before machining hollow camshafts, quenching and tempering operations at the proper temperatures are advisable to give the desired machinability.

Two methods are in use for carburizing camshafts so they can be straightened without breaking, after hardening. One method consists of copper plating the entire shaft prior to carburizing and removing the copper by grinding or turning from the areas that are to be carburized and hardened. The second method consists of forging or machining the camshafts somewhat larger, leaving an excess of metal between the cams and bearings. This excess metal is machined off after carburizing and before hardening. The carburizing operation should be carried out in containers and furnaces of suitable dimension and design to permit uniform heating throughout the charge. Table II gives the carburizing temperatures for various steels.

The camshafts should be so packed that the areas to be hardened do not come in contact with each other or with the walls of the containers. Sufficient compound should be used so that the camshafts are not exposed at any time during the carburizing and cooling operations. After carburizing, the camshafts are allowed to cool in the containers.

The time required to attain the desired depth of case, depends upon a number of factors, such as temperature of the furnace at time of loading, rate of heating, type of furnace, thickness of the containers, amount of stock left for grinding, etc. However, the carburizing time and the amount of stock left before grinding should be so regulated that the depth of case after grinding is at least 0.045 in. The hardness of the camshaft should not be below a reading of 75 on the scleroscope.

In hardening, the camshafts should be heated uniformly to the temperature given in Table II, and held for complete penetration of heat. The heating medium should be of such a character that no decarburization will take place. To prevent warpage, the shafts should be arranged properly in the heating medium and quenched vertically, or rolled horizontally into the quenching bath.

In tempering after quenching, reheat the camshafts in a suitable tempering medium to the temperature given in Table II, and hold at this temperature for at least one hour to insure complete penetration of heat. The highest temperature that will not affect the hardness, should be used.

The mixture of the carburizing compound is left to the judgment of the operator. Some operators add only enough new compound to replace the amount used during carburizing, while others vary the ratio from the above to a mixture of 50 per cent old and 50 per cent new.

There are several methods used for packing the camshafts. For example, a single shaft may be packed in a tube, or a number of shafts may be packed in a tube

Table II—Carburizing and Heat-Treatments for Camshafts

Steels	Carburizing Temp. Deg. F.	Cool in	Reheat to Deg. F.	Quench in	Tempering Temp. Deg. F.
S.A.E. 1015	1625–1750	box	1425–1450*	Water or brine	350–400
S.A.E. 1020	1625–1750	box	1425–1450*	Water or brine	350–400
½ per cent Ni	1650–1700	box	1375–1425*	Water or oil	250–450
S.A.E. 2320	1575–1625	box	1325–1375*	Oil	250–450
S.A.E. 3120	1625–1675	box	1375–1425*	Water or oil	250–450
S.A.E. 2512†	1600–1650	box	1350–1400*	Oil	250–450
Ni-Mo	1650	box	1475–1525	Oil	350
S.A.E. 6120	1675–1725	box	1425–1475*	Water or brine	400–450
Cr-V	1675–1725	box	1425–1475*	Water or brine	400–450

*Use lowest possible temperature to produce maximum hardness.
†After rough machining, anneal at 1,450 degrees F., air cool, finish the machining and then carburize.

or box of suitable size. The majority of the methods in use give good results if properly carried out.

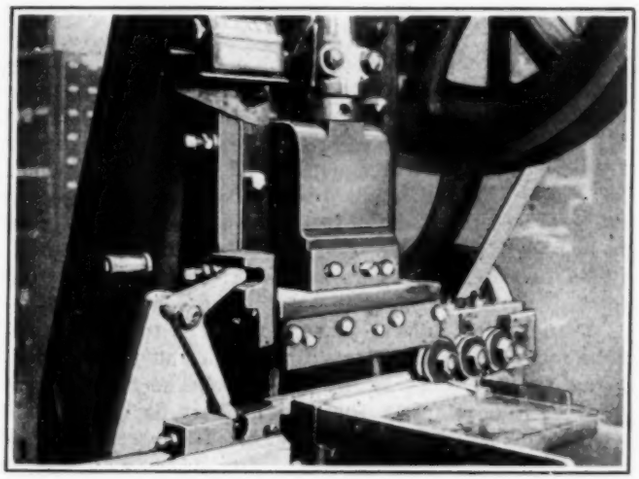
When using the plain carbon steel (S. A. E. 1020), satisfactory results may be obtained without annealing or otherwise heat-treating before machining, although by following the practice as given above, the steel will be in a better condition.

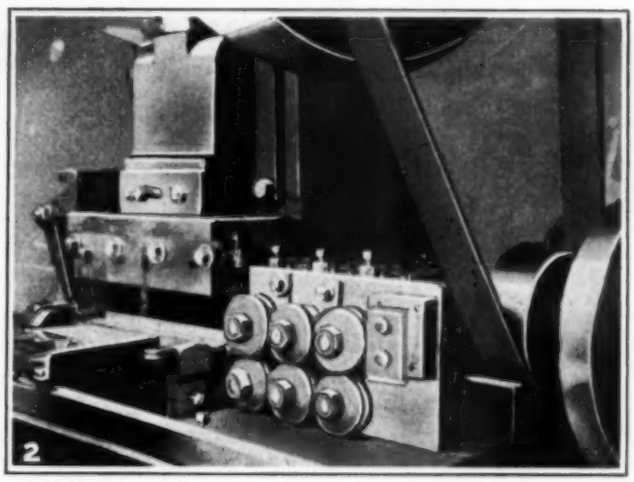
When using a salt bath as a heating medium for hardening, the shafts are sometimes preheated at approximately 600 deg. F., then transferred to the salt bath, in which they are suspended vertically to prevent warping, and maintained in the heating medium until they attain the proper hardening temperature. They are then quenched and tempered.

Press Tool Design of the American Multigraph Company

By W. E. Irish
Associate Editor, *American Machinist*

A combination of press and forming rolls—Forming a cylinder in one operation—Some examples of finger forming tools to combine vertical and horizontal tool movements





Figs. 1 and 2—Combination of press and rolls for forming a 30-gage tube

MANY small parts entering into the construction of the multigraph are made to advantage in pressed metal in a small press shop in the company's plant in Cleveland, Ohio. There are a dozen punch presses of various sizes busy most of the time.

This article deals with some of the typical designs of the tools and shows a number of good points of construction to produce the parts rapidly but without sacrifice to the very close limits of accuracy which must be maintained.

One of the parts is a type tube, which is made of 30 gage tinned steel. The part is approximately 9 in. in length by $\frac{3}{4}$ in. across its greatest dimension. Two views of the press set-up to do the work are shown in Figs. 1 and 2, while in Fig. 3 is an outline section to show the multiple action of the press tool proper and the contours of the auxiliary forming rolls.

The sheet is fed in on the table at the front of the press by hand, is perforated, cut off, formed into a U-shape, ejected from the forming die to the rolls, and there formed to the finished shape required. The whole assembly is mounted on an auxiliary bolster plate on the bed of the press.

The roll assembly is a unit in itself and is belt-connected to a pulley on the flywheel to run continuously. The gearing is such that the piece is fed through rapidly enough to clear the die for the turnover speed of the press, which is approximately 100 strokes per minute. To compensate for possible belt slippage, as succeeding pieces passed through the rolls, a flywheel is mounted on the roll drive shaft.

In Fig. 1 is illustrated the work eector that moves the formed piece far enough to be caught by the first pair of rolls. This ejector is set to move forward on the up stroke of the press and is located opposite the forming die in a position that does not interfere with the advance of the stock for the next hit as soon as the punch clears the die.

The work is fed over the table *A*, Fig. 3, and is gaged against the shoulder of the die shoe *B*. As the press descends the sheet is gripped between the table and the combination cutting-off punch and perforating die *C*. Cutoff occurs between the back edge of this punch and the front edge of the forming die *D*, the table and sheet descending under the action of the punch on guides in the shoe and against the action of springs between the table and the shoe. Near the bottom of the stroke a number of punches *E* pass up through the table to make the special perforations in the sheet that are required in each finished piece.

These perforations, which are approximately $\frac{1}{2}$ in. in length by $\frac{1}{16}$ in. in width, do not remove any metal, simply cutting it along the two long sides and one end leaving the blank fast at the other end. In the forming operation this blank is pushed back to lie practically flat in the finished sheet. The die for the work is made in the usual way, while the punch is ground, as shown at *X*, Fig. 3, to keep it from cutting on one end.

Returning to the description of the main die movements, a punch *F* located behind the cutting-off punch strikes that portion of the sheet that has been cut off very shortly after the cut is completed and forces it down into the forming die. The cam then returns

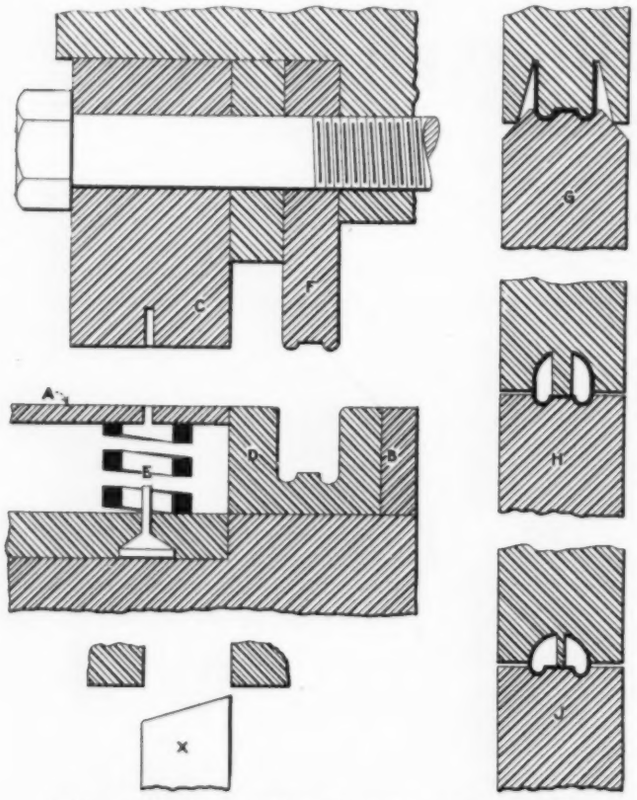


Fig. 3—Outline section of press tools and rolls

toward its top position, actuating the ejector to bring the U-shaped piece out between the first pair of forming rolls.

These rolls *G* do not change the shape, being intended to feed the work into succeeding passes, which are shown at *H* and *J* respectively. The pass at *J* indicates the final shape of the part.

A simple cylinder-forming tool is shown in Fig. 4, which can be used to advantage when the stock is of uniform strength and section, and where it is stiff enough to stand up without buckling while being forced around the center mandrel.

The tool consists of a punch carrying one half of the outside shape, a die carrying the other half which is

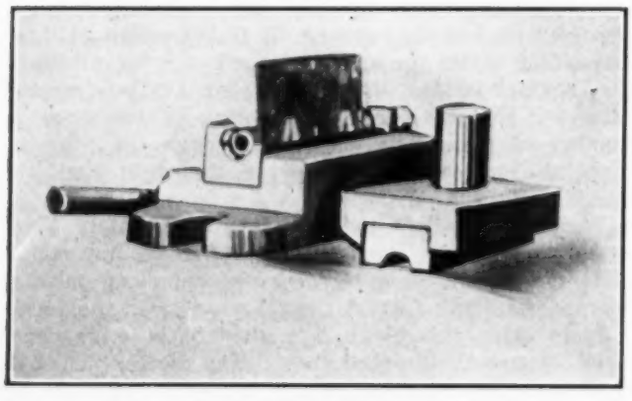


Fig. 4—A simple cylinder-forming tool

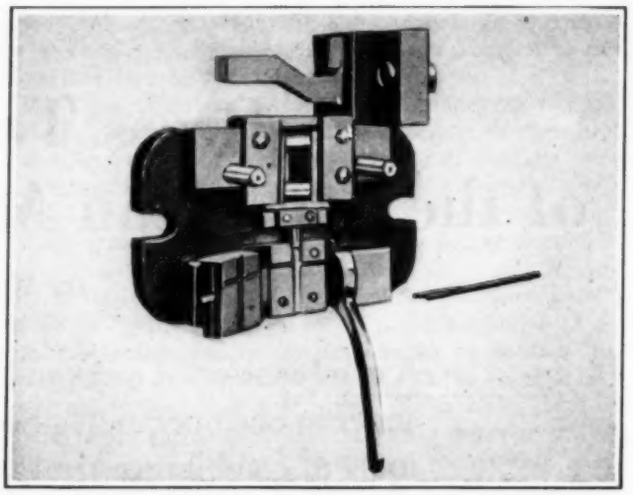


Fig. 5—Tool for forming an offset oval in a brass tube

fitted with a mandrel support at each end, and a mandrel. A pair of guide pins to locate the work so its edge will fall inside the half circle of the punch are also necessary.

In the tool illustrated a piece of cold rolled steel of 24 gage is formed into a $1\frac{1}{8}$-in. outside-diameter cylinder that measures about 10 in. in length. The mandrel is provided with a knurled projecting handle to facilitate its necessary removal and replacing after each piece is formed around it.

A number of operations are made in tools that are actuated horiztonally from fingers in the punch operating against slides in the die shoe. The construction used by the company for designs that do not include return springs is shown in Fig. 5. The particular tool

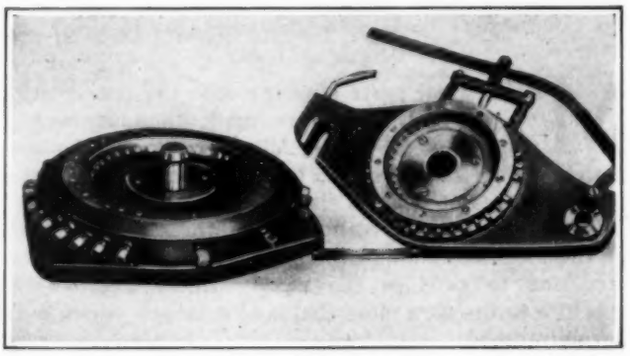


Fig. 6—A tool for accurately stamping figures on an index-gear hub

is for making oval the end of a $\frac{3}{8}$-in. piece of brass tube and for offsetting the oval. The principal point of interest, however, is in the actuating finger punch and the hardened rollers set in the slide in the die shoe. The actuating finger travels between the rollers, giving the slide a backward and forward movement.

Two other tools which use closing wedges in the punches to obtain horizontal slide movement are shown in Figs. 6 and 7. The first, Fig. 6, is a tool for stamping the numbers and accurately locating index marks on a ring gear. The gear is approximately 8 in. in outside diameter. The die to the right carries in this case 30 independent punches which are located radially under a ring. A raised collar in the middle of the die centers the work. A pin between ring and collar is used for locating.

The punch carries in its center a locating pin, a spring plate to hold down on the work and a substantial ring in which are set hardened steel plugs, one for each punch, to act on the beveled end of the latter as the punch descends. Each of these plugs can be independently adjusted and set by means of backing up screws and locknuts. On the front of the die is a spring arm that controls three knockout pins located below the work to facilitate removal.

In Fig. 7 is a part which is approximately 12 in. long by 1½ in. wide of 18-gage stock, and its second-operation forming tool. This part is made to a U shape in the first operation and finished in the tool shown. Since it is so long and narrow, it has no strength to stand up under end pressure and is, therefore, held flat

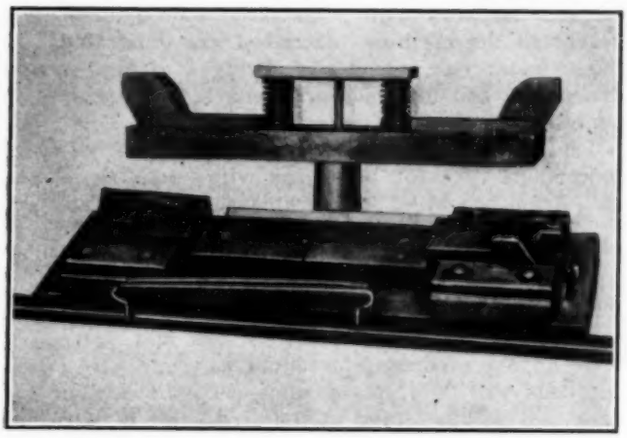


Fig. 7—A horizontally acting forming tool

by the spring plate in the punch while the die slides are closed in.

The tools for making a small brass part of peculiar shape are illustrated in outline sections of the two forming operations in Fig. 3 The part is of 24-gage metal

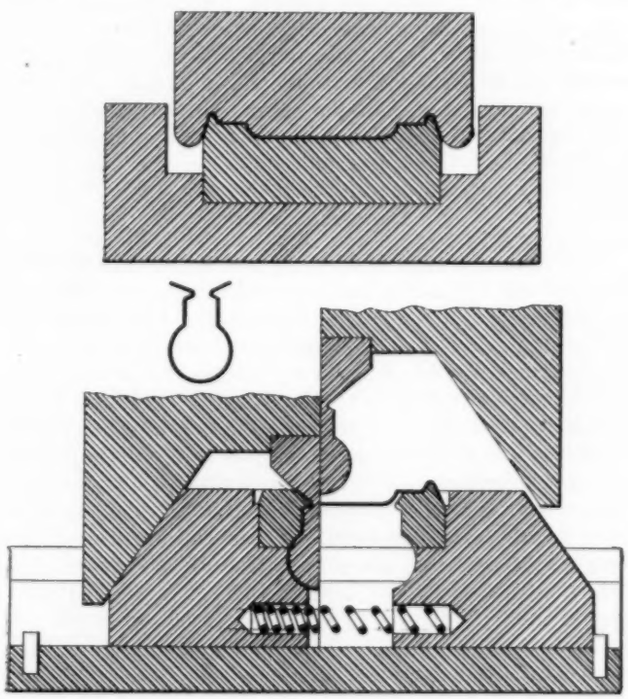


Fig. 8—Sections through the tools to form a complicated shape

and is approximately ⅜ in. in width by 1 11/16 in. long. It is shaped to a circle ½ in. in outside diameter that changes from this circle to two parallel legs which end in hooks.

All difficulty in forming this piece accurately is removed by the first operation tools, which are shaped to permanently set all the sharp changes of direction, and to make the beginning of the circular portion. The second operation then consists of pressing the part as shown between two horizontal slides in the die shoe, which is designed to follow inward the downward movement of the forming punch. The one point which is necessary to design with care in such a tool is the angle of the slide and closing wedges that the vertical and horizontal movements will synchronize accurately.

Throughout the press room is evidence of the company's regard for the safety and comfort of the men. Belts and wheels are carefully guarded and at each press is a combination seat for the operator and a positive safety device, which by strapping from the rear to each wrist positively removes the operator's hands from danger on the down stroke of the press.

At one end of the room is the die storage where the tools are kept between operations under the control of the press room foreman. It is the custom on completion of a run to inspect each tool before it is removed from the press and to return it at once to the tool department if repairs are needed so that on the die shelves are only those which are in good condition.

Cleaning Suggestions for the Shop

The recent convention of the service men of the Oakley Chemical Co., New York, December, 1925, brought out a number of interesting points regarding the cleaning of metal in automobile-shop work, and cleaning is just as much of a shop problem as machining. Parts that are drawn from pressed steel have to be cleaned of both the drawing compound and the rust preventive put on the sheet at the mills. When this is paraffin oil it requires a cleaning solution heated to about 200 deg. F. and a special mixture. Oakite was, naturally, the cleaning agent mentioned in the convention.

The use of automatic washing machines of various types was also discussed and the necessity for a thorough rinsing of the parts afterward, particularly for parts that are to be enameled. And even the rinse water must be free from lime or else the pieces must be wiped dry with rags.

Cleaning oil from work that has been heat-treated, requires a strong, hot solution of at least 8 oz. to the gallon of water. Where the work can come to the solution before it has had a chance to cool, it can be cleaned in 30 sec. The hot bath and the oil causes ebullition which helps to loosen the grease. If the work must be cooled first, it should be boiled in the solution for about 30 min. This time can be cut in half by adding 2 gal. of kerosene to each 100 gal. of solution.

Another problem is the effect of the cleaning compound on the hands of those who must handle the parts after they have been cleaned. Screw machine products are not usually rinsed on account of the liability of rusting afterward. Yet if an alkali solution is left on them, it affects the hands, cracking them or making them sore. A milder solution should be used in this case or a small amount of some film producing material, like a soluble oil, will remedy the trouble.

Book Reviews

Management in the Factory. By Glenn Leon Gardiner, M. A. 225 pages, 5x7½ in., clothboard covers. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y. Price, $2.

The book has been designed as a text for foremen who have interested themselves in strengthening their usefulness to industry and desire to understand the principles upon which factory management is established. The material was developed by the author in connection with a foremanship training course for the University of Wisconsin Extension. The principles presented are practical and useable, being based on actual operations.

The first chapter introduces the subject by showing a typical organization chart and by naming the major functions of each subdivision. More detail information is given on each in subsequent chapters on selling, purchasing, material stores, traffic, industrial welfare service, and others including a final chapter on business cycles and their causes.

The text is written without going into complicating details and the author has succeeded in gathering together a remarkable amount of helpful information to anyone who depends upon his connection with industry for his livelihood.

Bothering Business. By H. A. Toulmin, Jr. Fifty-six pages 4¾x7¾ in. Published by the B. C. Forbes Publishing Co., Inc., New York City. Price 50c.

This little volume takes up the unwelcome and, from the author's point of view at least, undesirable efforts of the Federal Trade Commission to control business. And he builds up a rather strong case by claiming that from 75 to 80 per cent of the complaints issued by the Commission against business concerns have been wholly unjustified. This has occurred, he believes, because the Commission regularly oversteps its authority and undertakes to do things it was never intended to attempt.

Many specific instances are cited and the impression is given, that the blunders made and damage done to business men must be due to lack of business capacity on the part of members of the Commission. The author fears, however, that harm might be done by the abolishment of the Commission, as is threatened, and feels that it should be reorganized, its methods changed, and even the act under which it was created, modified.

Atlas of Traffic Maps. By Wayne E. Butterbaugh. One hundred and eighty-four pages, 8x11 in. Published by the La Salle Extension University, Chicago, Ill. Price, $6.

Traffic problems in most manufacturing concerns are very important judged by the amount of freight charges incurred annually. The total charges are based on accumulations of individual freight rates. And the individual rates are based on tariffs of the most complicated nature. As a starting point, however, for clarifying the whole subject one must consider geographical sections of the country as separate influences upon rates. Some territorial jurisdictions overlap others, in which case, the traffic man who can find the lowest rate, will save the most money.

The Atlas of Traffic Maps serves just this purpose of visualizing the location and extent of the numerous territories, in a simple and readily comprehensible manner. It should appeal to beginner and expert.

In addition to the primary function, there are other transportation aids, including maps for parcel post and express rates, and airplane, steamship, and railroad lines. Because all maps are printed on single pages of the book it is handy for quick reference.

British Wire-Drawing and Wire-Working Machinery. By H. Durnell. One hundred eighty-five pages, 7½x11 in., board covers. Illustrated. Published by Constable & Co., Ltd., London, England. Sold in the United States by D. Van Nostrand & Co., New York City. Price $8.50.

A complete description of machines used in Great Britain for drawing and working wire. The author has covered the work with painstaking thoroughness, and nearly all the machines described are illustrated. In some instances, assembly drawings, giving enough dimensions and information to enable the machines to be reproduced, are included.

The machines described include those of almost every conceivable type for producing wire—both round and flat—from the billet to the finished product; also for making all sorts of articles from wire. The latter type of machines include those for producing wire netting; weaving wire; making electric cables; barbed-wire fencing; nails; rivets; pins, needles, safety pins; wire chain; paper clips; hair pins; springs, and mattresses.

To anyone producing or selling wire and wire goods, the book will be of great value. To the layman, the array of machines used in the production of wire and wire goods, is amazing.

Six-Place Tables. Second Edition. By Edward S. Allen, associate professor of mathematics, Iowa State College. One hundred forty-four pages, 4x7 in. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York City. Price $1.25.

A selection of tables of squares, cubes, square roots, cube roots, fifth roots and powers, circumferences and areas of circles, common logarithms of numbers and of the trigonometric functions, natural logarithms, exponential and hyperbolic functions and integrals.

The added material in the second edition consists of tables of natural logarithms, exponential and hyperbolic functions, and integrals; and notes on the theory of logarithms and the use of the tables.

Analyzing Foreign Machinery Markets Statistically. Glossary of Terms. Consecutive Bulletin No. 396, of the Department of Commerce. Published by the Bureau of Foreign and Domestic Commerce, Industrial Machinery Division, Washington, D. C. This bulletin was prepared in co-operation with the National Machine Tool Builders' Association, Cincinnati, Ohio. Suggestions to exporters are given on page three, as to the preparation of export declarations. The remainder of the booklet contains a list of the commodities, units of quantity and class numbers of products. These classifications are designed to assist in the preparation of the export statistics published by the department. It is desired that suggestions in regard to the present classification be made to J. E. Andress, Barnes Drill Co., Rockford, Ill., chairman of the National Machine Tool Builders' Committee on Co-operation with the Department of Commerce.

Automotive Production

Cylinder Bore Finishing

By Robert W. Adams

A symposium of the practices in ten of the leading automobile manufacturing plants

PRESENT practice in the finishing of automobile-engine cylinder bores was comprehensively covered at the December production meeting of the Detroit section of the Society of Automotive Engineers. Engineers from the Chrysler Motor Corporation, the Wilson Foundry & Machine Co., the Continental Motors Corporation, the Oakland Motor Car Co., Dodge Brothers, Inc., the Ford Motor Co., the Paige-Detroit Motor Car Co., the Hupp Motor Car Corporation, the White Motor Co. and the Buick Motor Co., gave details of the finishing methods employed at their respective plants and the reasons back of them.

In opening the discussion of the evening, P. A. De Vlieg, engineer of production of the Chrysler Motor Corporation, stated that the experience of his company with cylinder lapping covers a period of more than four years of development.

"Cylinders are lapped in two operations, roughing and finishing. The type of lap used for the two operations is the same except for the length and the shape of the stones on the cutting surfaces, the stones for the roughing operation having a concave surface with lands approximately ⅛ in. in width, and the finishing stones having a convex surface of the same contour as the cylinder wall. In the latter case, the stones are of much finer grade than those used for roughing and are approximately the full length of the holder whereas the roughing stones are approximately one-half the length of the holder and two stones are used, placed end to end in each groove of the holder. The number of grooves in the holder depending on the diameter of the cylinder to be lapped. The stones are backed by coil springs to give the desired pressure against the cylinder walls.

"Multiple-spindle machines are used with a rotating speed of about 275 r.p.m. and with a reciprocating speed of 40 strokes per min. A liberal supply of kerosene is pumped into each cylinder to keep the stones cool and cutting freely.

"The amount of material removed by the two lapping operations varies from 0.00005 to 0.0015 in., depending on the condition of the surface produced in the reaming operation just preceding the lapping. It is very essential, however, that the surface be smooth and that the cylinder be within very close limits of being round and without taper. The laps just described, which have been used for a long time, do not fully correct out-of-round or tapered bores, so the importance of accurately machined and smooth bores before lapping is quite evident. During the past few months some tests have been conducted with laps now on the market, that are designed to correct variations in the cylinder dimensions. These tests are still under way and no definite data on the results can be supplied until they are more complete.

Lapping is the most commonly used method of finishing the cylinder bores of automobile engines according to this symposium of engineers representing several large automobile manufacturing companies. The difficulties experienced in connection with grinding and lapping are explained as well as the processes used by each company. A ground finish is considered insufficient

"The investment in lapping equipment is only a small fraction of that required for grinding and the saving in direct labor is such as to make this process one of the outstanding changes in methods of machining that have contributed to the economies in the industry, and which, in turn, have been passed along to the buyer."

F. N. Thiefels, of the Wilson Foundry & Machine Co., followed Mr. De Vlieg.

"As Mr. Wilson stated in his letter, we lap all cylinder bores and sleeves, which make up the Knight engine assembly and also all cylinder blocks for poppet valve engines," said Mr. Thiefels. "The type of machine and lap used is of our own design. The cylinder lapping machines were built by the Foote Burt Co. to our specifications.

Automotive Production

"The lapping operation is one of the fastest in our machine lines, requiring from 20 seconds to one minute, depending of course, on the stock we wish to remove. Contrary to the experience of other manufacturers, we do not concentrate so much on the lapping operation as we do on the preparation of the bore before lapping. We have found that it is necessary to ream a round, smooth and straight bore for successful lapping.

"We hold the bores as received from the boring mills to not over 0.0005 in. out-of-round, and not over 0.0005 in. taper, which is a good commercial tolerance for finished bores, and our production lapping operation does not round up nor does it straighten the bore.

Salvaging Bores

"When bores are out of round and tapered in excess of our standard, we perform a salvage operation on a drill press on which we use a Hall lap, which expands equally on all lapping stones. This removes a certain percentage of the out-of-round condition and taper. We have never tried this lap in production as we believe it would increase our lapping cost considerably and there would probably be a let-down in the accuracy of boring operation.

"We allow plus or minus 0.001 in. tolerance on all bores in cylinder block and from 0.001 to 0.0015 in. on Knight sleeves.

"We are using two types of lapping stones. One is a ¾x¾-in. square, with the length depending on the length of bore, and a grooved hone. In order to tell the whole story in a nut shell, a number of pertinent items pertaining to our laps, as well as the costs, are listed.

Cylinder Blocks:

Lapping time 15 to 20 seconds.
Stock removed not over 0.0005 in.
Lapping stone ¾x¾x6-in. medium Carborundum on a bore 6½ in. in length.
Lapping stone ¾x¾x8-in. medium Carborundum on a bore 10 in. in length.
Cost of lapping stones, 45c. each, five stones used per lap.
Six laps used per set.
We can lap approximately 250 blocks per set of lapping stones at a cost of about 5c. per cylinder block, including labor.
The stroke of lap for 6½ in. in length of bore and 6 in. in length of hone is 3 in.
The speed is from 175 to 200 r.p.m. using approximately 100 reciprocations.
We determine our length of stroke by letting the stone project out of the bore about 1¼ in. at each end of stroke.

Sleeves:

Lapping time 30 to 45 seconds.
Stock removed 0.005 to 0.001 in.
Lapping stone ¾x¾x8-in. grooved Carborundum 150-G10 or Norton 120-0.
Cost of lapping stone 50c. each, five stones used per lap.
Sleeves are lapped singly on a one-spindle machine.
One operator can take care of from 4 to 6 machines.
We lap from 200 to 250 sleeves per set of 5 stones at an approximate cost of 1c. per sleeve or a combined engine cost of 15c. for 12 sleeves, which includes labor and overhead.
The stroke of lap for 11½ in. in length of sleeve is 6 in.
Speed, 200 r.p.m., using about 100 reciprocations.

A. R. Fors, production engineer in charge of tools, methods and equipment, of the Continental Motors Corporation, reviewed past experiences of his company in beginning his discussion.

"I was unable to get any definite information as to how we finished cylinder bores previous to 1906 when our plant was moved to Muskegon from Chicago. In 1906 we were grinding bores of all cylinder blocks on Heald internal grinders. In 1915 we reamed and lapped the cylinder bores on one of our high production motors.

"We have done some experimental work with the rolling or burnishing process. The tool consisted of hardened steel rollers mounted in an expansionable floating carrier driven by power machines. This was never used in production as we could not produce a round, true bore.

"The principle objections to grinding cylinder bores on the standard internal grinding machine are:

1. Grinding with a small wheel rotating at a high speed produces a fuzzy finish which is worn away quickly, requiring an early regrinding of the bore.
2. The grinding wheel is not supported rigidly enough and there is a tendency to produce a chatter especially when hard spots are encountered in the bore.
3. Dry grinding produces an out-of-round bore due to the heat generated.
4. The machine requires specially trained operators and at various times we have found it difficult to maintain production due to the lack of capable men.
5. Grinding machines require more constant attention than any other production equipment from an experienced repair man to keep the spindles and other parts of the machine in shape to produce satisfactory results.

"The following information pertains to the conditions under which we are finishing cylinder bores at the present time at our Detroit plant. This work was started in August, 1923. We do not feel that we have the last word in equipment for finishing cylinder bores, but we believe that some of the information submitted will aid in developing equipment that will meet the present day needs.

Finishing Cylinder Bores

"Let us take for example a six-cylinder block, with bores 3⅛ in. in diam. and 7¼ in. long.

"The cylinder block is received from the foundry with a core 2⅞ in. in diam. In our first machining operation of the bore we rough bore to 3 in. in diam. removing excessive stock only. In our second operation we bore to 3$\frac{7}{16}$ in. in diam. to straighten the bore. In our third operation we rough ream, leaving 0.015 to 0.018 in. of stock for size reaming.

"In all three operations we pilot our boring bar at both top and bottom to insure a straight bore in the engine block.

"Our size reaming operation is performed on a single-spindle reaming machine, one operator running four machines. Our reason for using a single-spindle machine is to give us holes of uniform size in the same block. We are using a spindle speed of 40 r.p.m. and a feed of $\frac{1}{32}$ in. per revolution. We use an 8-bladed left-hand spiral reamer, allowing the cylinder to float. It is very important to have an accurately reamed bore for size and finish. A cylinder is reamed in 5.6 min.,

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that is, 6 bores are completed with one man operating four machines. We leave 0.015 in. for the final finishing.

"Our lapping of cylinders is performed on a single-spindle machine, using a spindle speed of 400 r.p.m. and a hand feed. It is better to have a machine feed and we have under construction at the present time attachments to take care of this.

"The first lap we used had an aluminum body carrying five stones ¾x¾x6 in. held against the cylinder walls by spring tension. This did not correct errors in our reaming operation and usually left the bores bell-mouthed at the top caused when withdrawing the lap. Various other laps on the market were tried out with no greater degree of success. In November, 1923, we adopted the Hutto lap or grinder for production purposes.

I might say we are the pioneers in using this type of lap in production. The first Hutto lap we used was a 3-stone lap with a screw-driver adjustment that was designed for service work. When we were trying out other types of laps we had one of these brought in our plant and it was so successful from the start that we used them even in their original design. However, we soon found where this could be improved and made suggestions to the Hutto company accordingly. These suggestions were worked out and tested out in our plant which led to the product we are using at present. This lap is of a 6-stone type embodying a double 3-point contact support for stone. This 3-point contact principle in arranging the stones, makes the grinder self-aligning as well as self-centering. These features are due to the fact that the two adjusting cones and stone holder pins that rest upon them have certain limited freedom to float until the cutting surfaces of the stone are all parallel. This floating of the adjusting mechanism also compensates for any uneven wear of stones due to lack of uniform density in their composition. We have found that this lap will produce a round, accurate bore correcting any errors that may exist after reaming.

"A stream of kerosene is directed on the stones carrying away all loose particles of metal and abrasive from the grinding surface as fast as they are released.

"The bores are held to a limit of 0.0005 in. out-of-round and 0.0005 to 0.001 in. taper. Of course, the taper, if any, must be larger at the bottom of the bore. A cylinder bore is lapped in 1½ min. or 9 min. for a six-cylinder block. As I have stated, a cylinder is reamed in 5.6 min. or a total of 14.6 min. for reaming and lapping. When we were grinding a cylinder block of the same size it required 54 min., so there is a decided saving in direct labor.

"We believe we are getting a finish in our lapping operation, which is better and also more accurate than grinding. In conclusion, I would say that we are getting a better cylinder bore at a lower labor cost by our present methods than when we were grinding."

H. C. Miller, in charge of motor and axle production at the Oakland Motor Car Co., pointed out that "you won't get a good hone job without a good ream first."

Continuing he said: "Don't try to correct out-of-round conditions in the bore unless you correct the honing. We have tried various types of honing, including the solid adjustable types, but are doing just exactly the same thing today that we did when we started out in 1921. We use a five-stone hone with seven springs beneath each stone, giving a pressure of about 75 to 100 lb. against the wall of the cylinder and allow 0.0005 in. out of round and taper, and we try to maintain them, too. We generally do succeed in maintaining them.

The Lincoln Division of the Ford Motor Co. finds it necessary to both grind and lap its cylinders. The cylinder blocks are 225 Brinell hardness. This company leaves 0.004 to 0.006 in. for grinding stock and none for honing. Only an up and down movement of about 125 strokes per min. is used, without rotation. A check is kept on each grinding machine in operation

"One of the things that you are up against on the hone is bell-mouth at the top. We overcame that by using an occasional scrap block. We use a Moline honing machine which travels 200 r.p.m. and 50 strokes per min. We use an old block, placing it above and the hones don't have a chance to fly out. Unless you do this you are bound to get bell-mouth. We also found that as the lap wears and the slots become larger, the stones back up against one side. We found this to be an advantage, as we turn the stones around as soon as they get half way to a full round surface and it gives a narrow cutting edge. We use what we call a rough, semi-finish and finish ream, and we rough hone and finish hone, using a medium grade stone on the first operation and a fine on the second. Kerosene compound is used for lubricant. We tried all kinds, and found that nothing did better than kerosene so far. It costs us, for material, 2½c. per job. Our finish speed to lap is 160 and that is on a single-spindle machine run by a man who figures on giving one pass to each bore, but sometimes more is necessary."

G. D. Babcock, manufacturing engineer of Dodge Brothers, Inc., outlined very comprehensively the operations followed in the finishing of Dodge cylinders.

"So far as I have heard the speakers, we seem to apply a different method in the use of hones. The hones used in Dodge cylinder finishing are not rotated continuously, the action being essentially reciprocating, the hone turning approximately 15 deg. on each down stroke to obtain universal action around the bore.

"The principal operations on the cylinder bores are:

1. Rough fly cut.
2. Fly cut true.
3. Rough ream.
4. Finish ream.

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"On the reaming operations approximately 0.012 in. is removed. Inspection of any number of cylinders at random shows the variation at the end of the finished ream to lie well within 0.0005 in. out-of-round and straightness of bore. The details of the reamer are very important. In our type, the blades backed off, have a land on the leading edge approximately 0.010 in. wide. The reamer tapers toward the tang approximately 0.001 in. per in. This taper is further relieved to allow approximately ¾ in. only in length; that is, the cutting land is approximately 0.010 in. wide and ¾ in. long, receding in diameter 0.001 in. per in. The blade is very securely held; the reamer head and blades are heavy. The front of the blade is underground slightly. The blades are arranged in pairs, diametrically opposed, but the pairs are unequally spaced around the reamer body. The rough reamer has a right spiral of 6 deg. the finished reamer, a left spiral of 6 deg. Much variation from this slope largely affects the smoothness of operation.

Guarding Against Glazing

"Large stones are used in the hone. The grade of the stone is Carborundum FF-G-6; the lubricant, a high-test kerosene. If a heavy or oily kerosene is used, glazing of the stones is excessive. Each stone is backed by a steel pressure plate on which are cams riding on cones of a central spindle. On this central spindle, separating the cones, which are free to slide, is a No. 750 spring. The outward action of the spring on the cone through the cams, gives the required balanced pressure to the stone. The stones, pressure plates, central spindle and spring are all an assembled unit when in the driving head, and are free to float diametrically. The driving head is operated through a universal joint. This flexible arrangement corrects any slight lack of alignment as the hones are inserted into the cylinders. When out of action the hones are held in a retainer head, having bores lined with hardened steel rings, into which each hone is drawn. The machine used for this purpose is special Dodge design, 4-spindle, reciprocating the hones 240 times per minute. The lubricant is fed continuously through a settling system in which all emery particles are removed and fresh, clean lubricant is delivered continuously to the hones. With a proper selection of stones, and lubricant, cutting will continue at almost an exact uniform rate through the life of the stone, without any redressings being required.

"There is but one honing operation, and the operation is carried to that point where the slightest possible traces of the reamer are still left in the bore. If through accident, lapping continues beyond this point, the cylinder is then rectified by grinding and finishing to an oversize. Our practice is to lap a fixed number of strokes; that is, 240 strokes, or one minute, and with a grade of iron held closely, and precision used in reaming, the bore will finish almost uniformly the same. If underlapping occurs, the cylinders are again placed on the machine for a relap.

"The holes are held within 0.001 in. limit out-of-round and taper. In fact, there is practically no taper. The holes are straight with axes parallel, the surface is brightly smooth, and since the finish has been accomplished in a reciprocating manner, the grain of the cylinder wall is laid true with the stroke of the piston. The intent of honing is to stay within the limits of the reamer marks, but to clean and polish the cylinder wall."

O. H. Hovey, in charge of tools of the Lincoln Division of the Ford Motor Co., opened his talk with the remark that "I guess we are a little old-fashioned, but we still grind our cylinder bores."

Continuing, he said, "But, as admitted here tonight, to get a straight bore and a round bore, we have quite a job. As far as trying to get a straight bore without grinding or deflection on the spindle, is concerned, I don't see how they do it any other way. I believe the only way is to grind. In the first place our cylinder blocks are 225 Brinell hardness. This is a high degree of hardness for a block. When the block first came through we cussed the engineers in general. We make three operations on the boring. We leave 0.004 to 0.006 in. for grinding stock. When it is passed along to the grinder the operator is given a number. He, in turn, stamps the cylinder block after he completes the grinding operation. They reciprocate back and forth on the wheel six or seven times before they get down to size. We leave nothing for honing. As the block is passed on to the honing machine, which is of our own design, we also reciprocate straight up and down. We made quite a series of tests on these operations. We started out in the first place to use the revolving type. We found that it did not lay the grain and take the fuzz off. Therefore, we took the next step; that is, a one-quarter turn on the downward stroke, and found this a little better. The chief reason we discarded these two operations was the amount of bearing. It was not on only seven or eight blocks that we made this test, but on hundreds in series. The reciprocation on our machine is about 125 strokes per min. and our lapping is with a straight up and down movement.

Design of the Hone

"Our hone is of our own design, similar to that of which the Dodge representative spoke, with a 2-in. face and approximately 8 in. long. There are three stones having a coil spring in the center, bearing against the two outer cones on the end. The two outer cones bear against two cams fastened to the retainer of the hone. This operation takes approximately two minutes. We found out when we started to hone that we could not get very careless in our grinding. We found conditions after we started to hone that we never found before; spiral, waves and chatter. We had to hold our grinding down all the more. So, after we found those conditions in grinding that caused us to give the operator a certain number and when conditions were shown up in the honing we immediately shut down the grinding machine and made a check on that machine.

"Our stones are furnished by the Carborundum people and we pay a little extra for them. They have a dummy ring which is not solid. They diamond off these stones. This dummy ring gives us approximately the size of our bore.

"There is one thing in honing this hard block of ours.

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After possibly five or six cylinders, the stone becomes glazed, so we use a rough Ford cylinder block, place that in the machine, reciprocate it possibly one-half minute, and thus take off the glaze.

"Our piston presents another condition. Its Brinell hardness is 160 and it is of aluminum alloy. That is one of the conditions that started us honing. It is a little softer material than we were using before, and what we were after was to build a motor and not use the pistons for lapping. We found when using the revolving type hone and a one-quarter turn, that a certain amount of the load was necessary against the piston to lay this grain in the proper direction. In the proper inspection of our motors, which we hold down to a block test of 106 hours, we have eliminated the unsightly scratches and scores that might occur, and most of all, the wear of the piston. These conditions previously existed.

"The engineers here admit that it is hard to bore a cylinder and get it straight within 0.0005 in., especially on a multiple machine. I have seen it practiced and I have tried it myself. But that isn't giving you a straight bore. You are still depending upon the boring machine. If you have hard spots I don't know how you are going to take them out without grinding.

"Another thing, I hope in the near future somebody will be able to design a multiple grinding machine that will cut down this expense of which we are talking. I know one company in particular that built two machines of the multiple type, but they fell down. They are still working at it, and I believe in the near future that even the cheapest car will be grinding its bores."

V. Colleau, of the Paige-Detroit Motor Car Co., presented the experiences of his company in outline form. "We have three operations on our blocks which pertain to finishing bores: These are: (1) Mill manifold side; (2) mill top and bottom; (3) drill and ream dowel holes in bottom face.

"First: Make bores 3.135 to 3.130 in. in diam., locating from dowel holes in the bottom face; work done on one six-spindle Foote-Burt machine with spindle-guide bushings above the cylinder block.

"Second: Make bores 3.185 to 3.180 in. in diam., using same equipment as first.

"Third: Make bores 3.238 to 3.235 on a six-spindle Moline machine with bars running in guide bushings above and below block using both Gisholt and Kelly boring tools which are ground in place in the bars. In this operation the bores are brought within 0.010 to 0.012 in. of finished reamed size and are bored square with the bottom of block. After this operation and before the bores are finish-reamed, the balance of the machining operations are completed. The block is then washed and is finish-reamed while it is quite warm.

"Fourth: Finish-ream piston bores 3.2475 to 3.247 on a Baker single-spindle machine. The block is located and accurately indexed from bore to bore. The reamer runs at approximately 30 ft. per min. and feeds $\frac{1}{8}$ to $\frac{1}{4}$ in. per rev. The bores are reamed straight and round within 0.0005 in., free from scratches and chatter marks. We ream from 200 to 400 bores per grinding of the reamer.

"Fifth: Hone bores on a six-spindle Moline honing machine using Titan hone bodies. Each body carries four honing sticks 1x8 in. In this operation the bore is enlarged approximately 0.002 in. and we aim to finish the bore at this time. Our finish size is from 3.2485 to 3.250 and the bore must be straight and round within 0.001 in. All reamer marks must be removed, bore hones smooth and free from scratches from reaming.

"Sixth: Single-spindle drill press equipped with indexing fixture. In this machine any bores which are not to finish specifications are made so. The number of bores which require finish honing varies. We are using both Hutto and Council hones.

"In our Titan hones we use Carborundum 60-C-2 or G04, or C.P. Desano C-46-K. In the Council hone we use 120-G-3 or G-4 Carborundum sticks which were bought for the Titan hones. In the Hutto hones we use mounted sticks furnished by that company.

"We have been reaming holes straight and round within a limit of 0.0005 in. and our variation in size is also within this limit. We have never been able to duplicate this accuracy on the production basis by grinding. Therefore, we prefer reaming to grinding when a 100 per cent honed finish is required.

"The floor space required for reaming and honing is much less than for grinding. Investment in equipment, labor cost and cost of upkeep is also lower.

"After reaming and honing for several months we reverted to grinding. By using all the equipment we installed for reaming and honing we were able to ream to within 0.004 in. of finish size and grind on this amount of stock. We reduced the cost of the grinding operation from 60c. to 40c. per block. Then by adding two unskilled operators to the reaming and honing operations at a cost of 15c. per block we eliminated the grinding operation and in this way reduced the labor cost 25c. per block.

"For multiple-spindle reaming or for reaming blocks that are too heavy to float readily in the single-spindle reaming operation, I would recommend reamers as used by the Wilson Foundry and Machine Co."

L. M. Converse, engineer of the Hupp Motor Car Corporation, prepared a paper read by Dan Smith:

> Lapping or honing will not correct out-of-roundness in a bore and it is necessary first to get a good ream. Various methods of cylinder finishing agree, as a whole, on 0.0005 in. as the amount of stock to be removed in lapping and as the tolerance to be allowed on the reaming operation for out-of-roundness and taper. Several different designs of hones are used by these companies

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"Our cylinder blocks are reamed in four operations; rough, first and second semi-finish, and finish ream. Each operation is done on a multiple-spindle machine. The finish reamers are of a floating type with six blades, left-hand spiral, and operate at 45 r.p.m. with $\frac{3}{32}$-in. feed. The stock removed on this finish cut is 0.012 in., leaving 0.002 to 0.003 in. for lapping. While this is more stock than some manufacturers leave, we find it necessary in order to remove all trace of feed marks.

"Our lapping is done on a four-spindle machine for the eight-cylinder block and a three-spindle machine for the six. The work is shifted for alternate bores on account of the wide center distance required for our style lap."

G. E. Becktel, production engineer of the White Motor Co., of Cleveland, declared, "In spite of our experiments for about six or eight months, we have not as yet succeeded in getting to where we want to do entirely away with the grinding.

"Since listening to the speakers this evening, I just happened to notice the pamphlet that was sent out telling about this meeting, and I notice that the subject is 'Should Cylinder Bores Be Lapped or Honed?' I expected to hear something from some of these gentlemen as to why they lap or hone cylinders. Most of them have talked about the different operations, or how they are doing the honing. I feel more interested in why they do this than in the different operations, or how the different plants are doing it. Practically everyone has been through the same grind; trying to use everybody's hone and everybody's lap, and we finally came down to a design of our own which we think is better than the ones we can purchase, and generally is. Getting really back to the subject that this question indicates, I want to say that I feel that we lap or hone cylinders in order to give the customer a better grade of product when we turn out our car or truck.

"I have had quite a little experience in lapping and honing. I was connected with the Nash Motors Co. about five years. This company started honing cylinders in 1922 using a Moline machine, but its own type of hone, specially designed. After playing with this machine for about a year or so very satisfactory results were secured. Of course, the operations that come before the lapping and reaming have to be almost perfect or the lapping will not be perfect. Practically the same results from a motor were found after it stood a six- or eight-hour block test as from 5,000 miles of wear on the car, the cylinder block was in practically the same condition that it was after the car had been driven 5,000 miles. One great advantage is that your compression is greatly increased for the time the cylinder goes through the test.

"It was found that after a block had been honed and had been put through the motor test the compression had been increased all the way from 15 to 20 lb. pressure. After making tests and running cars from 5,000 to 10,000 miles, and tearing the car down and inspecting every working part of the motor, rings, pistons and bore, it seemed that in the honing operation and test practically the same results were being obtained as from this 5,000-mile run.

"There is another question that I would like to bring up. That is, why do some people grind cylinders before honing? If we grind before honing my experience has been that we have more scratches than we do if we ream."

J. G. Hammond, assistant superintendent of the motor plant of the Buick Motor Co., at Flint, Mich., brought the program to a close with a short summary of the methods there followed.

"We do not use a lapping process in the finishing of cylinder bores," stated Mr. Hammond. "We have tried a copper lap and lapping paste and also cast iron laps but the results have been unsatisfactory from a production basis.

"The final finish is secured with carborundum hones but the more accurate the bores are machined before honing, the better final results will be obtained. For that reason I will precede the description of the honing method with a description of the machining operations.

"The first operation is rough-reaming, which is done on six-cylinder vertical machines removing slightly over $\frac{1}{8}$ in. of stock.

"The next two operations are straightening, removing about 0.050 in. of stock in the first and 0.030 in. in the second operation. This is done on six-spindle horizontal boring machines using boring bars piloted at both ends.

"The next operation is finish ream done on six-spindle vertical machines with floating spindles removing from 0.010 to 0.012 in. of stock. The bores in the finish-ream operation are held to tolerances of 0.002 in. for diameter and 0.0005 in. for out-of-round and the same for taper. The squareness of the bore with the base is held to within 0.002 in. in the height of the engine cylinder block.

"The bores are then honed in six-spindle vertical machines using floating spindles so that the hones are free to follow the bores. The hone holder is made of aluminum and holds five carborundum which are $\frac{3}{8}$ in. square and 6 in. long. They are held against the cylinder walls when in the bore by springs behind each hone.

"The blocks are honed twice, first with a medium grade and finished with an F. F. fine-grade carborundum hone and with kerosene for a lubricant. The hones make 350. rev. per min. and also move up and down. The time per block is about 2 min. for each operation. The amount of stock removed is from 0.0002 to 0.0004 in. in each operation. If an attempt is made to remove very much stock with this style of lap it will increase the inaccuracy of the bore.

"It does not correct any taper or out-of-round condition. It does smooth up and improve the finish of either a reamed or ground bore. As the corners of the hones wear to the contour of the bore, they become dull and glaze and sometimes load so they are removed after about every twenty blocks and are redressed to a flat surface on a cast-iron surface place with carborundum grit and then are cleaned so that they will cut free.

"We have experimented with various types of laps or hones that have been brought in at different times. They have had different spring arrangements but none of them have given any better results than the one just described."

Making Engraved Rolls of Steel and Copper

Steel rolls are employed to produce designs on metal—One section of the design is first engraved by hand on a small roll, called the die—Two stages are necessary to transfer the design to the final roll

THE job of making engraved rolls of steel by means of which designs, more or less elaborate, are embossed or engraved upon strips, bands and wires of gold and silver alloys used in the jewelry trade, upon larger areas of (usually) baser metals from which cigarette cases, card trays, snuff-boxes and countless other objects of similar nature are made, for counterfeiting the "grained" surface of real leather upon the artificial product, and for finishing the surfaces of certain textiles, is one that calls for a high degree of skill. Though the product bears little resemblance to anything that might be found in an ordinary toolroom or machine shop, many of the tools and methods used are closely related if not actually the same as would be employed by a first-class diesinker.

The copper cylinders, too, that are the active agents in machines for printing figures and designs upon wall-papers and textile fabrics, painting continuous pictures on oil-cloths, or laying the elaborate and vari-colored patterns upon linoleums, etc., are products of the same shop, and up to a certain stage are produced by the same methods. The steel rolls are, of course, hardened and tempered for their work of impressing a pattern upon metal by causing the surface molecules to flow under heavy pressure. The copper cylinders, being merely carriers of coloring matter that is picked up by the minute depressions of the engraved surface and deposited upon the cloth or paper with which the cylinder is in contact, are not under appreciable pressure.

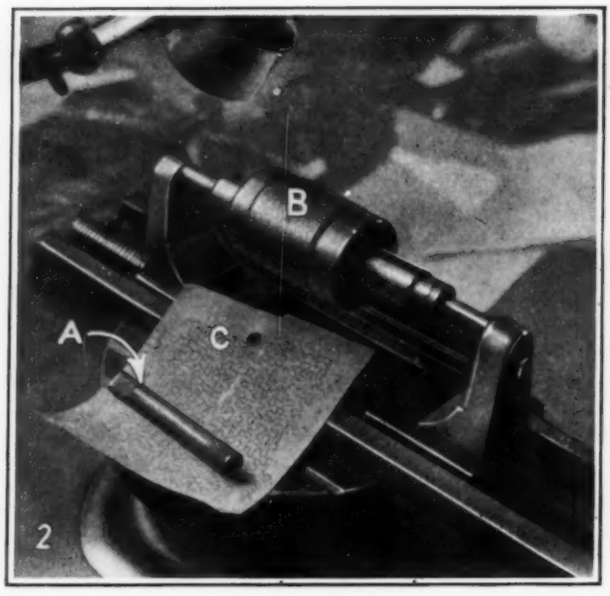
The first step in the process of producing either kind of roll is, of course, the conception and execution of the original design, and this is usually an "outside" job. Though some of the engraving plants employ men who are capable of producing excellent designs, this part of the work really lies in the field of the artist, and the designs are usually furnished to the engraving shop by the customer for whom the rolls are made. Many of the best designs are the work of European artists.

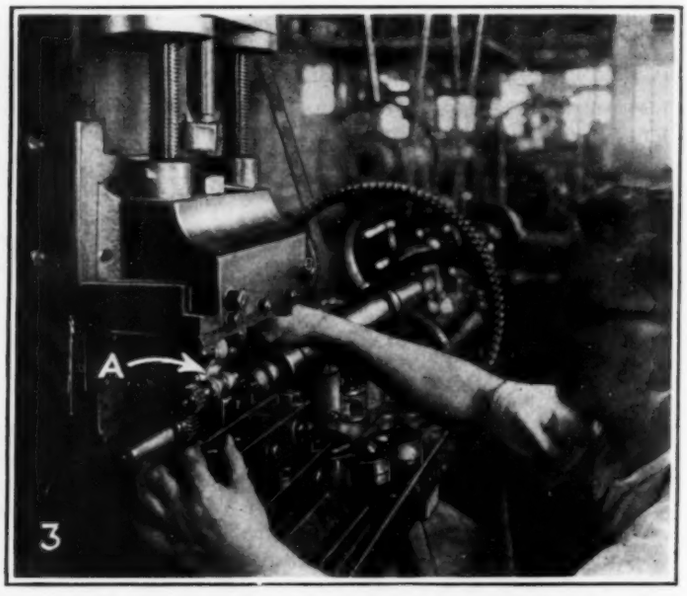
The first member of the engraver's staff, then, to take the work in hand is the "sketch maker." The original drawing often bears little or no relation in the matter of size to the pattern as it is to appear on the finished goods, and the sketch maker must first reproduce it to a size that will fit a definite number of times into the circumference of a roll. This work is done largely with the aid of a photographic reproducing camera, or projectiscope, by means of which the sketch maker may bring the pattern exactly within the bounds he has carefully calculated for it.

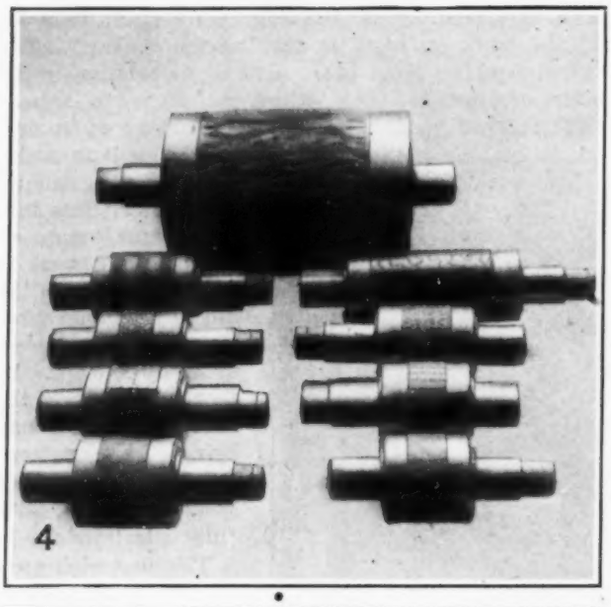
Fig. 1—Making the die

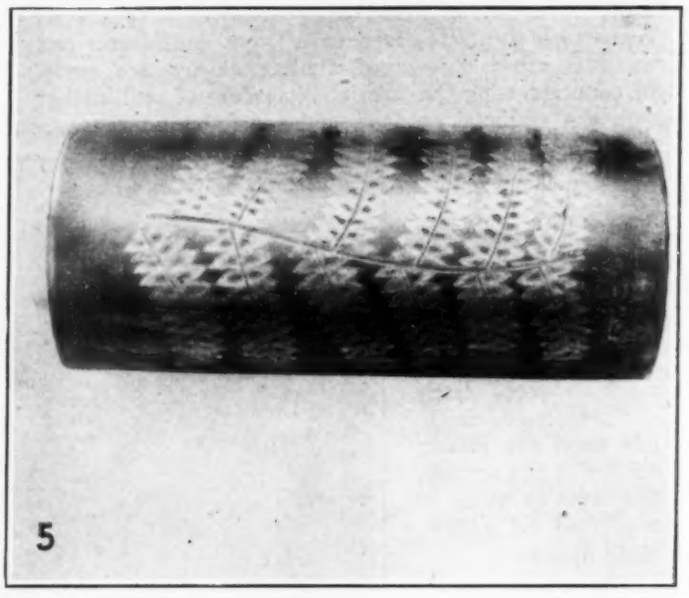
The material upon which the sketch maker works is a very thin, pliable and transparent film of celluloid. The design is put into the projectiscope and focused upon a sheet of white drawing paper pinned to the table of the machine. By manipulating the adjustments of the camera, enlarging or reducing as the case may require, the design is made to fit into the prescribed limits and is traced with a pencil. This work is necessarily done in a semi-dark room. The drawing is then retraced on the celluloid.

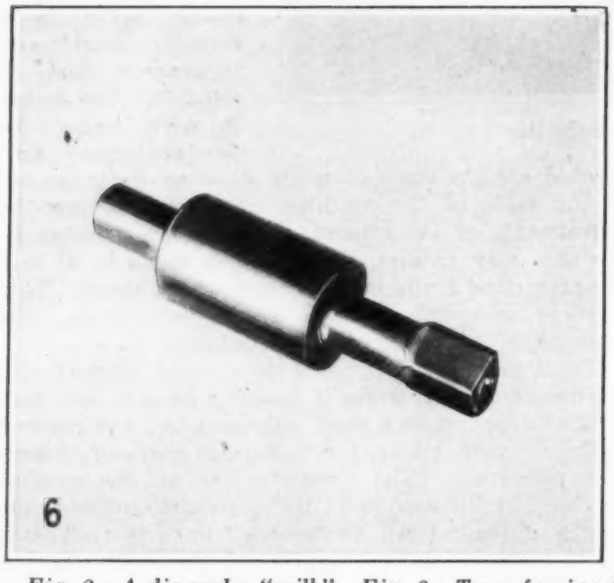
The diemaker, Fig. 1, takes the strip of celluloid with the design upon it, wraps it around a piece of steel that is to all appearances a small lathe-mandrel, and cements it thereto with a transparent varnish made of turpentine and rosin. The circumference of the mandrel —which, by the way, is a "die"—is exactly equal to the length of the pattern, or "sketch," upon the celluloid; there must be no overlapping of the ends, nor can it fall short of surrounding the die completely. The trouble attendant upon the first error is obvious, the second would leave in the continued pattern of the











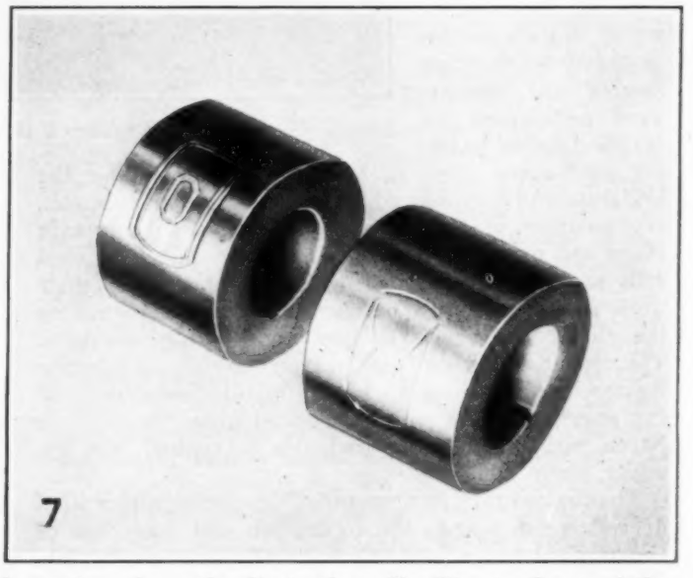


Fig. 2—A die and a "mill." Fig. 3—Transferring the pattern from the die to the mill. Fig. 4—Some of the finished mills. Fig. 5—A larger example. Fig. 6—Blank for a metal roll
Fig. 7—Shell rolls for metal

goods a hiatus that obviously did not belong there.

The tools used by the diemaker are the familiar hammer, chisels, riffles and gravers of his brother, the diesinker. His work is held between a pair of centers mounted upon a swiveling "die-ball" that enables him to turn it about to any angle or position

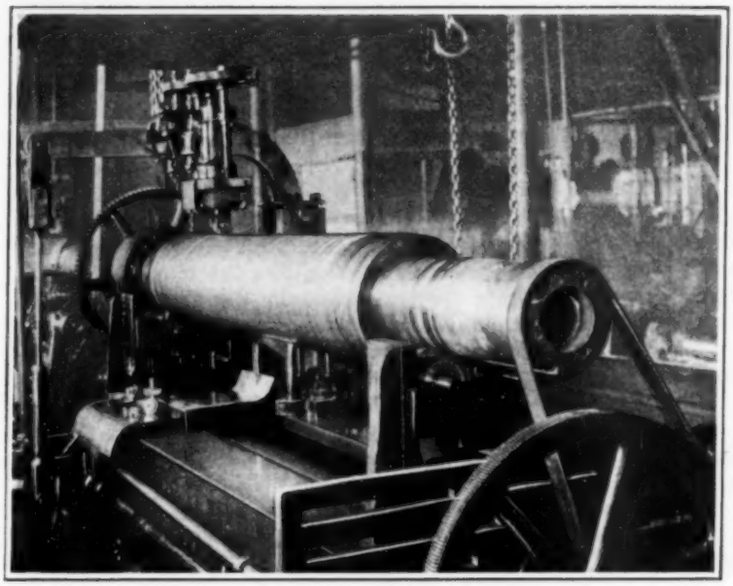


Fig. 8—Knurling a "Schreiner" roll

that may be convenient for him to work upon it. His job is to transfer the design upon the celluloid to the steel, and this he does by pricking through the pattern at the essential points, stripping the film and connecting up the dots thus formed with his graving tools.

A die may be seen in Fig. 2 at *A*, lying upon a sheet of paper to which its design has been transferred (though not directly from itself) for the purpose of inspection. Its resemblance to a lathe mandrel will be readily noticed.

The deep knurling upon the body of the die at each end of the pattern is very essential to its purpose, as will be explained, but is no part of the pattern. The piece *B* in this illustration represents the next step in the process of transfer and is called a "mill," or sometimes a "hub," and the centers upon which it rests are those of the swiveling die-ball.

Though lathes are not shown and but casually mentioned in this article, the reader will understand that there is a considerable amount of ordinary lathe work to be done in the preparatory stages; lathe work that compares very favorably with that done in a first-class toolroom. The die-blanks must be turned to exact diameter, shouldered, flatted for driving dogs, etc., and the blanks for the mills turned to equally exact diameters. It will be noticed that the mill shown at *B* in Fig. 2 has been reduced in diameter at the ends immediately adjoining the pattern, but this is an after process.

It is not the diameter, either of the die or of the mill, with which the diemaker is primarily concerned, it is the circumference; though he arrives at this latter dimension by calculating the diameter mathematically and measuring it carefully with a micrometer. As we have seen, the circumference of the die must correspond exactly with the length of the sketch. Equally essential is it that the circumference of the mill blank shall contain that of the die a definite number of times without remainder.

The transfer of the design on the die to the mill blank, and later from the finished mill to the final roll or cylinder, is done by a process of rolling, analogous to knurling, an operation which the engravers call "milling." The length of the circumference of the mill, while containing that of the die a definite number of times, must also be contained in that of the final roll a definite—and prime—number of times.

The reason for this latter peculiarity of relationship may be explained as follows: The mill blank is for convenience made three, five or seven times as large as the die, and the finished mill thus has upon its surface an equal number of impressions from the die—all of them exactly alike, due to the fact that the die usually carries but one reproduction of the pattern.

If, because of distortion in hardening or other cause, there should be a trifling variation in the multiple pattern as represented by the mill, and, further, if the circumference of the final roll or cylinder were a multiple of that of the mill, each set of three, five or more impressions upon the latter would coincide at each revolution of the roll with those impressions made on the preceding revolutions.

When the prime relationship exists, however, the mill will overstep or lag behind one or more impressions at each revolution of the roll or cylinder, like the hunting tooth of a gear, and a possible error in any one impression will be corrected by succeeding impressions.

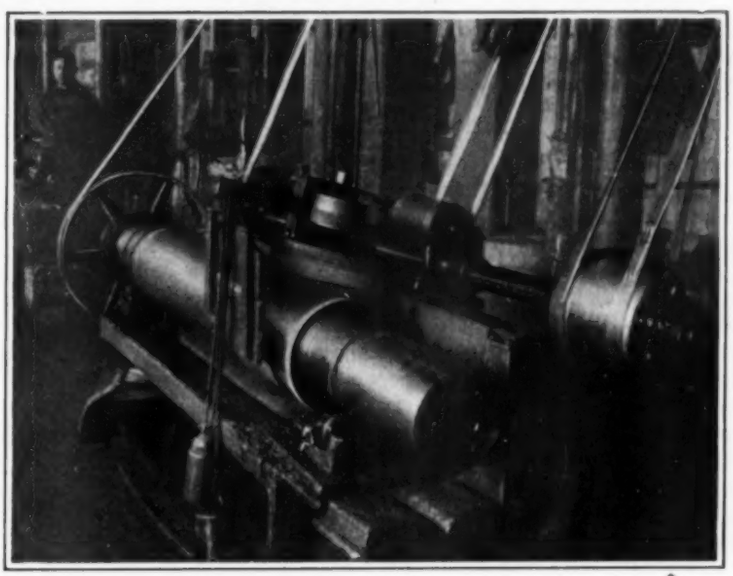


Fig. 9—A special grinding machine

The machine shown in Fig. 3 is essentially a screw press with two screws geared together at the top of the housing to move the gate. In the fixture on the bed of the press are two parallel rolls of soft steel with

their axes lying in the same horizontal plane and they are both gear driven from a shaft that passes through the fixture below them. The rolls are placed just far enough apart in their bearings so that their adjacent faces will not touch each other.

The die lies loosely upon these rolls, as may be seen at *A*, and the mill blank to which the design of the die is to be transferred is guided by open inverted bearings under the gate of the press, the body of the mill resting directly upon the die. As the supporting rolls revolve, the die as it rests upon and partly between them is caused to rotate in the opposite direction. As the mill blank is forced into contact with the die by the pressure of the screws, it, also, is caused to rotate.

In Fig. 2 it may be seen that the middle portion of the die presents a smooth surface, broken only by the fine sunken lines of the pattern engraved into it, while immediately adjoining the pattern at each end the body of the die is roughly knurled. This knurling has nothing to do with the pattern, but is of prime importance to the operation of transfer.

As the pressure of the screws forces the mill blank into contact with the hardened die the roughly knurled surfaces of the latter sink into the soft metal of the blank and the two pieces thereafter run together as if geared, while if the lines of the pattern, only, were depended upon to keep them in step the result would be slippage, or creeping, and consequent failure. After the transfer is completed the rough knurling is turned off the mill, leaving it as here shown.

The first stage, that of raising the rough knurling upon the mill blank, takes place very quickly. In the transfer of the design, however, it is not the comparatively small amount of surface occupied by the lines of the pattern that is to be impressed into the blank, but the relatively large areas between them. The lines of the design must actually be raised above the surrounding surface.

Applying the Wax

After rolling the pieces together and increasing the pressure from time to time until the safe limit has been reached, an operation requiring but a very few minutes, and recognized by the experienced operator from the "feel" of the lever at the top of the screws, a small lump of wax is thrown into the revolving parts and allowed to distribute itself over the surface of the mill (and, incidentally, over everything else in the immediate vicinity). Wherever the embryo raised lines of the pattern appear on the surface of the mill blank the wax adheres, but it is squeezed out by the pressure from all other places in contact.

The operator now takes the blank out of the press, places it between a small pair of centers made by bending up a piece of stiff spring wire, and spins it dexterously with the lower part of the circumference just dipping into the acid, which is contained in a shallow earthenware dish. Within a few seconds the entire surface is covered with minute frothy bubbles as the acid gets in its work on the unprotected steel, leaving unattacked the fine lines that are covered by the wax.

This part of the work requires even less time than the rolling, and when the operator thinks it has been etched all it will stand without endangering the lines of the pattern he washes off the remaining acid and puts the mill back in the press to be rolled again. The alternate rolling and etching is repeated anywhere from three to a dozen times, depending upon the height to which the embossed lines must be raised and upon the intricacy of the pattern.

The rough knurling on the ends of the mill are now turned off and it goes back to the diemaker for inspection and possible correction. To make this job easier, the mill is coated with printers' ink and rolled on white paper, where the embossed lines leave their imprint as at *C* in Fig. 2. Slight defects may be corrected at this stage by careful use of the graver, and when the mill finally leaves the diemaker's hands it is ready to be hardened. Figs. 4 and 5 show examples of finished mills.

Any of the mills shown could be used to roll metal, but if they had been intended for that purpose they would have had larger necks, like the blank in Fig. 6, or would have been made as in Fig. 7 to go on the arbors of a special rolling machine.

Use in the Textile Mill

Large steel rolls with finely knurled surfaces are used in some textile finishing plants to impart a peculiar sheen, or luster, to certain goods. The "design" in this case consists of very fine lines, 300 or more to the inch, laid upon the surface of the roll as a helix. Fig. 8 shows such a roll in the "milling" machine with the job nearing completion. The mill, or knurl, was made by the method above described and is here shown transferring its pattern to the steel roll. The machine is the same as is employed to make the delicate designs upon the copper cylinders of the textile printing machine, and will be shown later in connection with that work, at which time its functions will be described.

The steel rolls are produced by ordinary machine shop methods, including grinding them round and parallel upon a standard cylindrical grinding machine, but the surface left by the regular grinding wheel is not good enough for the engraver and he therefore puts a new roll into the machine shown in Fig. 9 to regrind the surface and leave the dull matt finish required.

This machine consists primarily of a bed upon which are two saddles, adjustable lengthwise of the bed to accommodate different lengths of roll, each saddle carrying two rollers upon which the journals of the roll to be ground are borne. The drive to the work is by belt to a large pulley that is centered by setscrews upon the neck of the roll. The grinding medium is an annular ring of a fine-grained Scotch sandstone—called Water-of-Ayr stone—that rests by its own weight, and the overbalanced weight of the grinding head, upon the surface of the roll to be ground.

The side of the stone is the grinding face. The grinding head pivots about the axis of a coarse-pitched screw which extends over the length of the machine and by which the head is caused to traverse slowly back and forth as the grinding proceeds. The stone is not rigidly confined by its spindle, but is allowed a certain latitude in which to float and adapt itself to the surface of the roll. Additional weights suspended from the head increase the pressure as desired.

The object of this machine is not to produce a truly round cylinder of accurate size—which it probably would never do—but to put a certain required finish upon a roll that has already been ground round and parallel by other methods, and this job it accomplishes well and quickly.

(To be concluded)

Alcumite—An Aluminum Bronze Alloy

By Peirce D. Schenck
President, The Alcumite Corporation, Dayton, Ohio

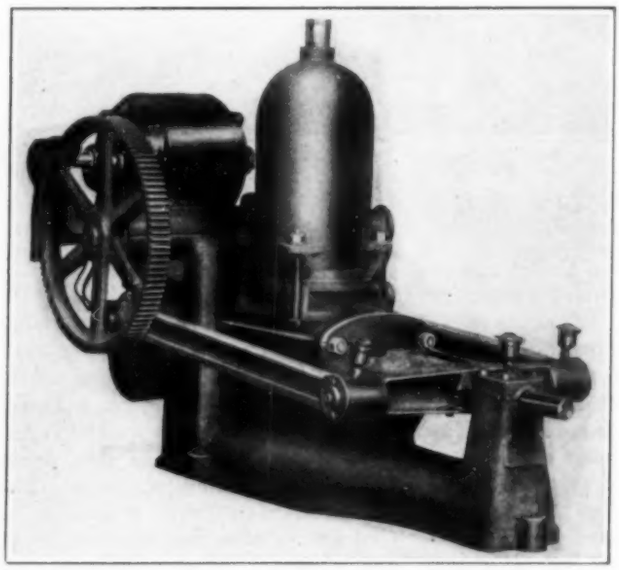
Physical and chemical characteristics—Methods for machining, forging, rolling, spinning, welding—Typical applications in service—A partial view of its range of usefulness

THE ADVANTAGES of aluminum bronze have been known to mechanical and chemical engineers for some time, the outstanding characteristics being resistance to corrosion and to mechanical fatigue, and high tensile strength. To offset these advantages, however, the alloy has been difficult to cast, roll, forge or otherwise work.

Alcumite is a new type of aluminum bronze so radically different in composition that in order to avoid confusion, the trade name "Alcumite" was adopted. The composition of Alcumite is varied, depending on whether the alloy is to be used in castings or forgings and occasionally for resistance to certain specified corrosives. It is a copper-base alloy with appreciable percentages of aluminum, iron, manganese and nickel.

While Alcumite was developed primarily as a corrosive resistance material, it has shown such remarkable physical characteristics that its field of usefulness has been broadened and many applications, where corrosion is not a consideration, have developed.

The physical characteristics are given in Table I, in which it should be understood that the Brinell hardness figures were determined with a 3,000 kg. load and a definite time period of 30 seconds. In Table II are shown further physical characteristics of cast Alcumite



A pump made entirely of Alcumite

The parts are made of Alcumite castings and forgings bolted together with bolts of the same material. It is used in conveying sulphuric acid to and from storage in connection with acid manufacture and acid use in pickling operations in the metal industries.

at elevated temperature conditions through several steps.

Alcumite is not a universally acid-resisting metal, since it was designed primarily with the one, sulphuric acid, in mind. In this acid, it is entirely suitable for use in solutions under 60 deg. Bé. and as high in temperature as the boiling point. It can also be used in this acid with concentration from 55 to 85 per cent when the temperature does not exceed 80 to 90 deg. Centigrade.

The metal is highly resistant to the action of a wide range of corrosives. Many tests have been made to determine the corrosive loss from contact with each, but the figures are from laboratory tests and are not entirely reliable commercially. This is on account of the variation in commercial chemicals, and it is recommended that separate determinations be made in specific cases.

Table I—Physical Characteristics of Alcumite

Specific gravity	8.3
Weight per cubic inch, cast	.30 lb.
Melting point	1900° Fhr.
Coefficient of expansion per one degree Fahr.	.00000935
Thermal conductivity, B.t.u. per sq.ft., per degree Fahr. difference in temperature	48
Electrical resistivity, michrohms per cubic centimeter	18.6 (or 112 ohms per circular mil ft.)
Electrical conductivity	9% of copper
Shrinkage, inches per foot	$\frac{1}{8}$
Brinnell hardness:	
Castings	130
Hot rolled sheets	195
Hot rolled, annealed	141
Ultimate tensile strength, lb. per sq.in.:	
Castings	75,000
Hot rolled	110,000
Hot rolled, annealed	90,000
Percentage elongation in 2 inches:	
Castings	30%
Hot rolled	10%
Hot rolled, annealed	25%

Service, as well as laboratory test, has shown Alcumite to be suitable for the construction of ventilating equipment intended to handle most of the fumes encountered in industrial work with the exception of the gases from nitric acid. For chlorine, hydrogen-sulphide, methane, oxygen, sulphur-dioxide and hydrogen gases the loss is negligible, in the period of a year the highest showing 0.0126 inch.

It is ordinarily a very difficult matter to prevent porosity in making castings of aluminum bronze. For Alcumite, this has been largely overcome, however, through development of the alloy itself and through working out a special foundry practice. Castings, when correctly designed can be poured to withstand a hydrostatic pressure of 1,000 lb. per square inch.

The design is an important factor, considering the comparatively high shrinkage and the tendency toward rapid setting from the molten point even when poured

at about 2,150 deg. F., the correct pouring temperature. This setting begins to take place at approximately 1,850 deg. F. It is a good policy, in connection with the design, to follow accepted aluminum practice. The cast-

Table II—Physical Characteristics of Alcumite Castings at Elevated Temperatures

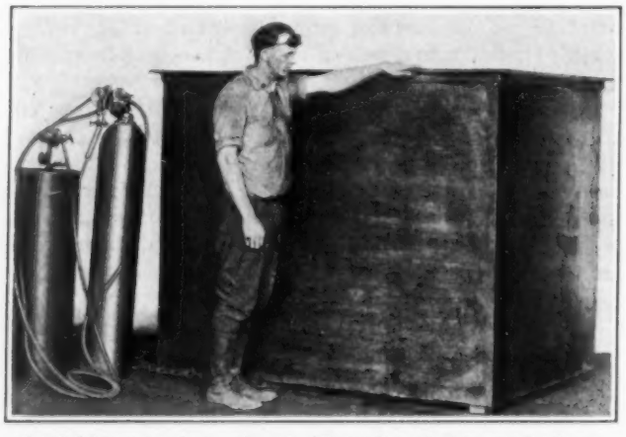
Temp.	70 F.	500 F.	750 F.	900 F.
T. S.	73,165	58,740	36,525	23,560
Y. P.	22,440	26,520	23,460	17,340
ELON.	38.5	18.5	6.4	7.5
R. A.	35.0	30.0	13.0	10.5

ings should be as nearly uniform in thickness as possible, and where it is necessary to change section, the change should be gradual. Bosses, heavy ribs and other characteristics of design that involve unusual volumes should be avoided.

To insure pressure-tight castings, it is advisable to keep the minimum section at ⅛ in. or thicker. Castings with this minimum section extending for distances that would require the metal to flow through the mold for any considerable length is not best practice. The molten metal, as it flows, has a tendency to form oxides which are apt to result in segregation of dross and in consequent porosity. In some instances it is advisable to change patterns that are submitted for castings in order to provide for gating that will insure an adequate flow of metal into the body of the mold.

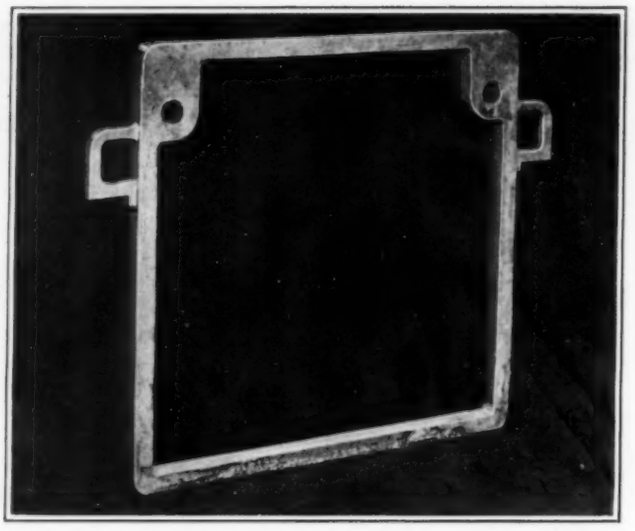
These points are mentioned more to bring out the importance of correct design and the fact that certain conditions peculiar to Alcumite must be observed to get results. As a matter of fact, all the casting of Alcumite is being done by its makers, who have studied and fully understand the requirements.

Machining involves considerations similar to those for a medium carbon steel. A slightly longer time element is involved, however, than in either steel or ordinary 90-10-2 bronze. A cutting speed of approximately 80 ft. per min. is good practice. Apparently, a carbon steel works to best advantage when it is given plenty of clearance and is kept sharp. The burnishing action of the tool is not marked, as in the case of cutting many aluminum bronzes, but there is this tendency. Assurance of clearances and maintenance of the cutting edge relieve the difficulty.



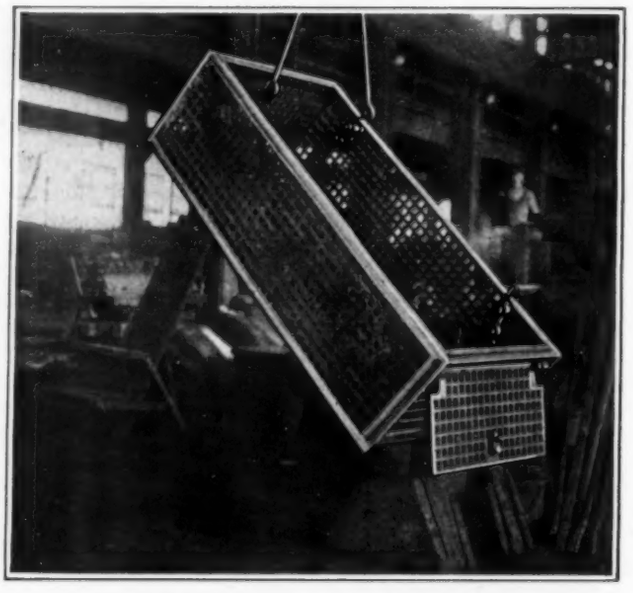
A pickling tank made of Alcumite sheets and shapes

The sheets were squared and then tack welded in place against a backing of Alcumite angles in the corners and around the top edge. The welding was then completed using the gas torch and welding sticks made from the sheet material to insure uniformity.



An Alcumite casting for pickling service

The illustration is a good example of what can be accomplished with correct gating and with pouring practice that will cause an even flow of a metal usually difficult to handle in the molten state.



Pickling basket for small forgings

The basket is built up of Alcumite castings that are held together with rods of the material riveted over on the ends. The swinging end assists in unloading the small forgings after they have been pickled.

Alcumite is readily forgeable, but requires a somewhat different treatment than either steel or other nonferrous metals. The power required for rolling it is 40 to 50 per cent in excess of that needed for a corresponding reduction of carbon steel, but it can be rolled into shapes or drawn into wire as small as 0.005 inch.

The rod and sheet billets are usually sandcast. The possibility of pouring clean castings is here demonstrated by the fact that scalping or machining prior to rolling is usually unnecessary. Most of the rolling operations are performed at a temperature of approximately 1,600 deg. F. It is imperative that the billets be thoroughly soaked and brought up close to this temperature to insure good results.

Spinning and drawing are possible to an unusual

depth, but, here again, the longer time element must be observed in obtaining proper results.

At the present time, two grades of Alcumite sheet are produced. Grade "G" can be annealed by heating to a temperature of 1,450 deg. F. and then quenching it in water. Grade "D" can be annealed by heating to about 1,500 deg. F. and then cooling it slowly. This latter grade is best adapted for deep drawing and difficult forming operations.

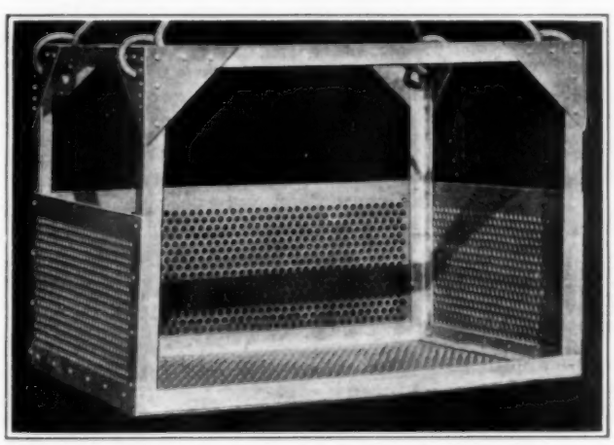
After a little practice, the metal can be welded with the use of regular Alcumite welding sticks and flux. The welding sticks are made either from special cast welding rods or from special cold-drawn Alcumite wire, or from strips sheared from the sheets. The cast sticks are recommended for welding castings, and either the cold-drawn wire or the sheet strips of the same thickness as the sheets to be welded are best for welding sheets. The flux should be used liberally and can be applied dry, although some welders prefer to mix it with water to the consistency of cream and to then coat the rod and the work.

The acetylene torch can be used to produce the best results when using a welding tip about one size larger than would be used for the same thickness of steel. It is recommended that a ripple weld be made with the torch and that the rod be used to work out the oxide. Extreme care must be used in this connection, for, if the oxide is not thoroughly worked out of the weld, a porous spot will result. The oxide shows up clearly as a white dross, and if it is found necessary to reweld at any point, some difficulty will be experienced due to the high expansion of the metal.

In butt welding, a contraction of $\frac{1}{16}$ in. per foot for a sheet equivalent to No. 8 U.S.S. gage should be allowed. The proper contraction to figure for on other gages will be in proportion to the gage.

In making preparations for welding two sheets, it is good practice to clamp both of them on the top and bottom with a rigid member to prevent warping. Angle iron has been found to work nicely in this connection and should be clamped about 2 in. back from the edge of the sheet. Wet rags or some water cooling fixture should be located behind the angle because of the high heat conductivity of Alcumite.

In welding thin metal, it is often best to turn up an angle on each sheet about twice the thickness of the plate and then melt this angle down with the torch, fluxing it thoroughly and using the welding rod for puddling. In welding corners on sheet, it is suggested that the edges be tacked about every four inches, leaving a space of approximately $\frac{1}{8}$ in. between the edges. This space is then filled in with the welding rod.



A structural pickling basket for small parts

Structural angles and plates are used in the construction. The plates after perforating under a punch press are riveted to the angles with Alcumite rivets. The angles are of cast Alcumite. The plates are rolled. With one material electrolytic action will not occur.

Sixty-gallon chemical still

All parts of the still are of cast Alcumite. The joints are machined to give tight fitting surfaces and the parts are then bolted on with Alcumite bolts, studs and nuts. A gate valve is shown clamped in place on the flange to the left for future connection to a line.

Castings that are to be welded should be preheated to a dull red before the welding operation is started. As with the sheet, care must be taken to thoroughly work out all of the oxide. Best results will be obtained, particularly on heavy work if the casting is cooled slowly. Light-section, small castings can, however, be thrown into a bucket of water after the welding is completed.

The properties of Alcumite make it available for application over a remarkably wide range of uses, particularly where resistance to acids, fumes, salt water or atmospheric corrosion is a desirable factor, or where a material of great strength, ductility and resistance to fatigue is indicated.

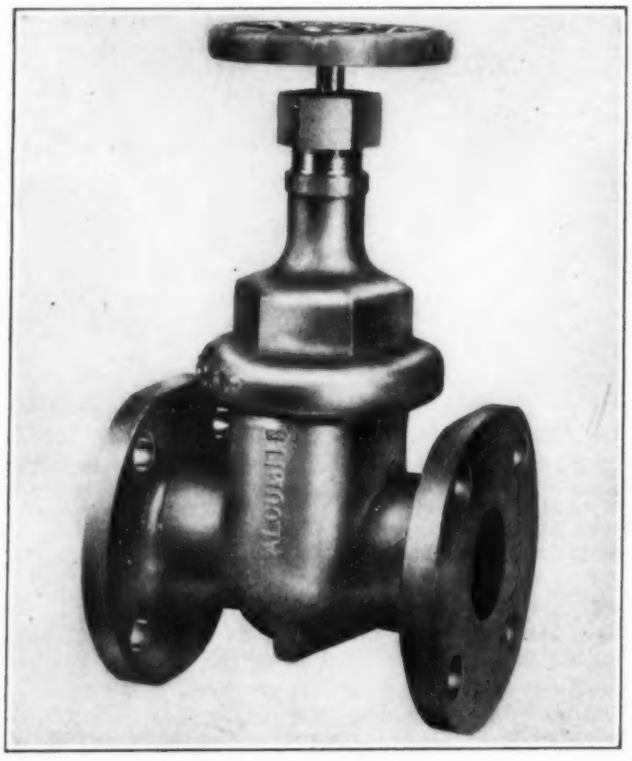
Pickling baskets, hooks, slings, wire rope, chain, tank tierods, outlets, guides and various special fittings for pickling crates and tanks, as well as the construction of parts for continuous and semi-continuous pickling equipment, are representative of one of the fields to which its application is particularly suited.

Pumps, reciprocating, centrifugal and rotary in design, are being manufactured in Alcumite and are recommended for handling any corrosives after the proper tests have been made to check the laboratory tests to indicate its availability.

Exhaust fans, in standard types, are also available

for handling corrosive fumes and vapors from various industrial operations. Alcumite sheet is used extensively for the construction of ducts, fume lines and stacks. Drawn seamless tubing in iron-pipe sizes from 1 to 3 in., as well as cast pipe, are carried in stock by the makers. Screwed and flanged fittings are furnished in a cast form.

A particular advantage of Alcumite is that any piece of equipment at present manufactured from other materials can usually be built of it without more than minor change of design and without any change in tool equipment. Many standard pieces of equipment are now



An acid-resisting gate valve

Flanged and screwed valves and fittings of many sizes and descriptions are made entirely of Alcumite for use in high temperature work as well as in connection with acid conveying distribution systems.

being manufactured entirely of the material using die tools and other production equipment originally designed for steel. An obvious advantage of constructing machines that must resist the attack of acid and other corrosives in one material, even including the bolts, rivets or small parts, is that any possibility of electrolytic action is avoided.

Besides castings, sheet and rods, Alcumite is available in the form of bolts, rivets, washers and wire. Standard or special cap screws and all variations of punching and screw-machine parts can be turned from stock bars.

It pays to know that castings are not too hard, before they get to the machine. A little time in sandblasting and pickling may save a lot of time later, as well as many dollars worth of cutting tools. Saving a little money by buying cheap castings is usually expensive economy. The results prove rather conclusively that one gets, in value, almost every time, an amount equal to that spent, but not any more.

The National Museum of Engineering and Industry

By L. L. Thwing

IT MAY be a few years before we can walk into the industrial museum, but we may expect the project to begin to take form now that a definite start has been made and sponsored by such men as Edward D. Acheson, Thomas A. Edison, Fred A. Geier, Samuel Insull and H. D. Sharpe. It is not too early to think about what sort of an historical exhibit the machine tool and shop men would like to have in it—assuming that we can get what we would reasonably like to have. Those industries that are ready with definite plans and with machine tools ready to be assembled for exhibition purposes will probably get more consideration than those organizations who are not prepared.

It was not so long ago that when a man wanted shelter, food or tools he had to make them himself. A machine tool is a machine-building tool, something that must be built before any other sort of metal contrivance can be made. The early machine shops built their own lathes, planers and drills because there was no place to buy these necessities. The author has seen three old planers in a little shop in Vermont. The smallest one was made by the use of a lathe and hand tools only. It was used to make a planer about one and one-half times as large with the platen and bed in four parts and the rail in two parts. This process was repeated again to make a planer with a 4x8-ft. table.

Old Machine Tools Wanted

There are many similar machines, native products, examples of American design uninfluenced by English practice if it could be known where they are. In connection with the development of the projected museum it is necessary to locate such machines so that some one will know where they can be found. It would be appreciated if anyone who owns or who knows of an old machine tool built before 1870 would send a brief description of it to the Secretary of the National Museum of Engineering and Industry, Mr. H. F. J. Porter, 29 West 39th St., New York City.

An ideal exhibit might well start with the lathe on which, according to Plumier, Solomon turned the columns for his temple and proceed down through history with examples of the machinery in the workshops of Hero, Archimedes, Da Vinci to the more recent tools described by Amman, Leopold, Moxon, Zonca and in Diderot's French Encyclopedia of the Arts and Trades. We would then come to the Revolutionary War that stimulated the development of our own machine shops. The author has never seen or heard of any existing tool built during this period but it may exist.

Such lathes as the one with which the Putnams started business in Fitchburg or the one that Baxter D. Whitney built for himself when he could not buy one, would make admirable exhibits. These lathes were probably scrapped years ago but we are getting down into the times within the memory of man and more examples of this class may be found. If sufficient searches and reports are made, it will be possible to assemble a considerable number of pre-Civil War machines and it is to be hoped that even those who are not interested in this movement will assist those of us who are.

Thrift—To the Last Man in Industry

By Fred H. Rindge

Thrift stabilizes industry—Habits of wastefulness rot character—The program for Thrift Week—Past results of thrift campaigns on community life

THE stage is set for National Thrift Week, January 17 to 23. The teaching of thrift should be of vital concern to every business man in America, for it tends to stabilize industry and increase the happiness and efficiency of the working force. Thrift is an essential to success, prosperity and happiness and a vital part of the nation's business.

Says Roger Babson: "Thrift produces prosperity. To develop individual thrift is a pressing national problem. Thriftlessness, the American characteristic, is due to a lack of 'know-how.' Almost any man who tried to run his business in the way he finances his home—without a definite plan—would end in bankruptcy."

No doubt, thrift like charity, should begin at home, but all too often it does not begin there. Hence, the task of Management is not merely to practice thrift but also to preach it. Many an industry has found that a wise campaign for thrift among all its employees, young and old, white and black, foreign and American, is worth infinitely more than it costs. Clarence Howard, President of the Commonwealth Steel Co., declares: "Millions of dollars are kept out of circulation because of the lack of confidence of people, especially those of foreign birth, in our American institutions. Thrift campaigns can be very helpful in teaching the service which is rendered by the bank, building and loan associations, insurance companies and other institutions."

During Thrift Week many industries are arranging for groups of employees to visit the banks; talks will be given in English and foreign languages, and the purpose of the bank fully explained and demonstrated. New York City banks have agreed to be hosts to 300,000 boys and girls. In one town last year over 1,000 new accounts were opened in a single bank as a result of such promotion. Bankers of Fresno, Calif., offered a small bonus to every child in the city who started a bank account, and the results were amazing. Saving clubs are being organized in hundreds of industries throughout the nation. This means far more than money saved. It means inculcating the spirit and habit of thrift in thousands of working people, who have heretofore never really set aside anything worth while for the rainy day. The economic program is practical, because it helps men to a basis in life where the higher experiences can be appreciated and enjoyed, for without release from financial worry a full and normal social and spiritual freedom is impossible. A man's money and the way he spends it affect his whole career. Habits of wastefulness and extravagance rot character. They make a man poor, rob him of his judgment, steal his health and undermine his integrity and honesty.

No worker who is seriously in debt or constantly harassed by financial worries can be industrially efficient. According to Webster, to thrive means "to win success by industry, economy and good management." Thrift is common sense applied to the spending of money and the business of living. Industrial workers can be taught that a savings account lays the foundation for a comfortable old age; that the contents of the pay envelope is safer in the bank than at home and earns interest for them in addition to their deposit.

"Beware of Small Expenses
A Small Leak will Sink
A Great Ship"
Benjamin Franklin

ECONOMIC PROGRAM INDUSTRIAL DEPARTMENT THRIFT NO. 6

The wide-spread enthusiasm over National Thrift Week is evidenced by the fact that forty-eight different national organizations, mostly of a business character, are co-operating in promoting it on a large scale.

Here is the week's plan:

January 17—Share with Others Day.
January 18—Thrift or Bank Day.
January 19—Budget Day.
January 20—Life Insurance Day.
January 21—Own Your Own Home Day.
January 22—Safe Investment Day.
January 23—Pay Bills Promptly Day.

The mere mention of this plan for the week enlarges one's conception of the true meaning of thrift. It involves not merely persistent earning and saving but also careful buying, wise investing, conscientious planning and proportionate giving! With this in view, the following experiences of various cities should prove suggestive to all industries and business

organizations interested in the promotion of thrift:

In Dayton, Ohio, the National Cash Register Co. presented 10,000 budget books to house-wives, volunteers distributed 25,000 thrift circulars, and many addresses were delivered. Hundreds of thousands of budget books were scattered throughout the county. The Gulf State Steel Co., of Alabama, purchased 1,000 for its employees; the Dime Savings Bank of Detroit distributed 1,500 among the colored families of the city; the city treasurer of Lansing, Mich., personally supervised giving books to all taxpayers who visited the City Hall; foremen of the Bayonne, N. J., shops gave several thousand to their workers.

A Big Insurance Day

Life insurance companies of America wrote $75,000,000 worth of business as a result of National Life Insurance Day. The company, owning the largest electric sign in Elmira, N. Y., flashed the thrift idea every night for a week. In many industries experts rendered personal service in connection with making a will, by entering the shops and helping the workers understand their financial problems better. It was estimated that the thrift slides shown each night in the motion picture halls of Troy, N. Y., reached 52,000 people. In Joplin, Mo., thrift leaflets were placed in laundry bundles and wrapped with packages in various department stores. Boy Scouts were effectively used in many towns. Scout masters devoted meetings to thrift subjects, the boys assisted in a house-to-house distribution of literature, and paraded the streets during the busiest hours, carrying thrift posters.

At Hartford, Conn., 83,000 people received an inspiration to thrifty habits at a cost of $876. Over 8,000 budget books were put into use. Indorsement was secured from the Governor of Connecticut, the Chamber of Commerce, the Rotary Club, the Kiwanis, Civitan, and Lions' Clubs, Y. M. C. A., Federation of Women's Clubs, etc. Ninety people served on a committee and sixty-six gave their services as speakers. One hundred and forty-seven thrift talks reached 22,500 and literature was distributed to 45,000. Eight hundred large posters were displayed in store windows; the newspapers ran 85 articles; there were 51 billboard advertisements. Over 5,000 "Pay Your Bills Promptly" leaflets were mailed to customers by merchants with their monthly statements.

The South Dramatizes

Lexington, Ky., devised an ingenious scheme of putting into circulation extra large checks accommodating many endorsements and bearing the inscription, "Swat Old Bill." Newspapers notified the people that the old whipping post was to be restored on the spot where it had stood years before and that an old offender was to receive twenty-five lashes. A huge crowd gathered to witness the lashing of the effigy Bill D. Linquent!

At Lynchburg, Va., forty-four different organizations co-operated in the observance of National Thrift Week, which was financed by eight banks and directed by the Y. M. C. A. Special meetings were held in twenty-two places including factories, colleges, freight sheds, city clubs and stores. Short talks were given before schools, churches, young people's societies and Men's Bible Classes. Thrift slides were shown in motion-picture houses; 30,000 pieces of printed matter were distributed, thrift essay contests were conducted, newspapers carried advertisements of the committees each day of the week and the whole population of the city was reached.

In Butler, Pa., one baker co-operated by putting small thrift stickers on each loaf of bread made during the week. All street cars carried thrift posters, and a boys' thrift club was organized, the only membership requirement being that each member have a bank account and make regular deposits at least once a month. A Franklin supper was held, banks distributed budget books, motion picture theaters ran slides, a thrift exhibit was placed in the courthouse lobby and a unique "Own Your Home" exhibit was placed in the Y. M. C. A.

In one community men impersonating Ben Franklin and two town criers gave six hours each day for the entire week without expense. They visited schools, every club, many industries and distributed literature. Twenty-five high school students in the public-speaking class accompanied them and spoke in theaters, factories

No man has to experience this to learn
"SAFETY FIRST"

YOUR FAMILY'S SAFETY
should be first and
should be provided for
by regular savings
from your income

and schools. Over 23,000 children wrote essays on thrift and competed for nineteen prizes. Ben Franklin opened each bank in the city on his birthday, with a big brass key. A parade was headed by the mayor.

With an active committee of men of vision, Detroit devoted $6,300 and a large amount of energy to one of the best observances of National Thrift Week ever held. Over $4,600 went into display advertising, $1,000 to literature and exhibits, and $1,200 to follow-up. The last item points to a new day in Thrift activity. Sermons on Thrift were preached in fifteen churches, 50,000 leaflets were distributed and radio reached 600,000. Approximately 75,000 were stimulated to a greater appreciation of banking institutions, 10,000 to a new understanding of building and loan associations, 55,000 of life insurance, 50,000 of home ownership, 60,000 of sharing with others, 40,000 of making a will, 65,000 of paying bills promptly, 100,000 of making a budget and 40,000 of investing safely. The newspapers reached 4,900,000, the advertising being handled by a committee appointed by the Adcraft Club. Merchants, schools and civic organizations co-operated

with enthusiasm. Thrift was the dominating thought of this great city for the entire week.

In Dallas, Texas, the Chamber of Commerce issued a proclamation and supplied a radio speaker and news articles. The Junior Chamber of Commerce devoted its house organ entirely to thrift, opened its luncheon meetings to thrift representatives and itself assigned campaign speakers. Law, mercantile, insurance and building and loan firms incorporated thrift in their advertising, contributed financial aid and speakers and used 300 window displays. Churches furnished five speakers, in addition to thrift sermons, Sunday School and Young People's Society talks and news stories. The Credit Men's Association helped with the finances and contributed press advertising. The Post Office distributed 16,000 slips and posters, bringing the total local distribution up to 62,475. Newspapers gave a circulation of 200,000 to the mayor's proclamation. They printed five cartoons, 126 news items aggregating 2,890 sq.in. and 153 display advertisements totaling 7,000 inches. The schools conducted a slogan contest with cash prizes, and later an inter-school competition of the winners with additional awards.

New York Co-operated

The Thrift program in New York City reached practically all of the more than five million population. The Y.M.C.A. branches in the metropolis conducted the regular program and carried thrift messages to the 60,000 members and many others not in the membership. Ben Franklin's birthday was observed in the City Hall and at the Franklin statue with appropriate exercises under the auspices of the Sons of the American Revolution. The Building and Loan Association held a Franklin Day Banquet at the Astor Hotel. Adolph Lewisohn, Chairman of the National Thrift Committee, broadcasted a thrift message to the nation, and on each day other thrift talks were broadcasted. In the auditorium of the John Wanamaker store a thrift meeting was held each afternoon under the auspices of the Federation of Women's Clubs. The Post Office co-operated by putting thrift posters on every mail wagon in the city and the postmen distributed Thrift Week literature. Many business concerns carried thrift advertisements in the papers. In Long Island City 100,000 people were reached mostly through shop meetings in industrial plants.

It is to be hoped that every city and business concern in America will promote all these activities and many more during 1926. There is every reason for National Thrift Week being the most significant week of the year. President Coolidge well says: "It has been not only the vision and the high purpose of our forefathers, but likewise their work and their savings, which have created our Country, and on the continuation of which the whole future welfare of our people rests!"

The more we know the more we realize we have to learn. An eminent professor of mechanical engineering told recently how he had refused to try to solve a problem involving the stresses in a round shaft with a rectangular hole, a problem that he would have "solved" in fifteen minutes ten years ago. His explanation for refusing was that he feared he would not live long enough to evolve a solution that would satisfy his conscience.

A Steam Hammer "Comes Back"

By W. Snaith

During the war we bought a second-hand steam hammer; and the subsequent events make a story that should be told, because of the morals and conclusions which may be drawn. If a happy ending makes a story good it can be set down right now that this is a good story.

There are people still alive who remember that back in 1917 machine tools disappeared from the market and anyone who had one to spare borrowed the "Standing Room Only" sign from the theater and put it outside his office door.

About the time that this situation was becoming acute, the boss undertook to equip a machine shop out on a construction job. I found some of the machines myself and the steam hammer was one of them. It was a funny-looking old timer; reminded me of a church steeple. It stuck up a long way in the air and came to a point on top. They tried to make machines attractive in the days when this one was built. From the dust on it I guessed that the dealer had had peaceful possession of the relic for a long time. But I couldn't go back to the boss without some kind of a steam hammer and this was nearly the size he wanted. *Nearly* was as close as anything those days.

We paid for it, and after a considerable lapse of time the railroads delivered it to us. While we were waiting for the foundation to be finished we piped it up. When we turned on the steam and the piston went to the top of the cylinder and stayed there, the applause would have gratified the most blasé comedian in the country. The only ones who didn't appreciate the humor of the situation were the boss and me.

Something was perceptibly wrong with its insides, and it didn't take long to get the cover off the steam chest and find that the valve was missing. The office got busy and wired the dealer who sold the hammer to complete delivery by mailing us by first-class mail and special delivery one missing valve. It didn't seem likely that they'd be able to do all this at once so we found a serial number on the nameplate and wired the manufacturer, asking him if he could supply one valve for the ancient steam hammer. Meanwhile the master mechanic measured things up inside and started shaping up a block of cast iron into a valve.

The first to be heard from was the manufacturer. He didn't have a valve and was too busy on war work to make one for a couple of years. He did, however, mail us a blueprint of the hammer.

Then came an apologetic wire from the dealer. He had been afraid to leave a brass valve of such size and weight in a flat car shipment and had taken it out; then the shipping clerk forgot it. It came by express in a day or two.

The master mechanic's valve was finished the day after he started it and the old hammer apparently liked it first rate, because as soon as he got it in and covered up, the blacksmith put the hammer into service and it never went out of service until the construction job was finished.

With the blueprint came a letter from the manufacturer, explaining that the hammer was made before the days of interchangeable parts, and only a few machines had been made of this particular design. The date on the drawing was some time in 1872.

Ideas from Practical Men

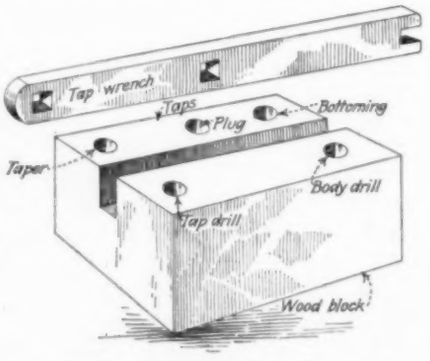
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Keeping Tools in Sets

By Fred W. Hall

The illustration shows a very convenient block for holding all the tools that are necessary in drilling and tapping holes of a certain size.

Holes are provided for a set of three taps, a tap drill and a body drill. The tap wrench fits in a slot running lengthwise of the block. We have been keeping our tap and drill sets in the toolcrib in this way for the last ten years, and have found the method to save considerable time, since all the tools are kept together and are issued to the workman on one check.



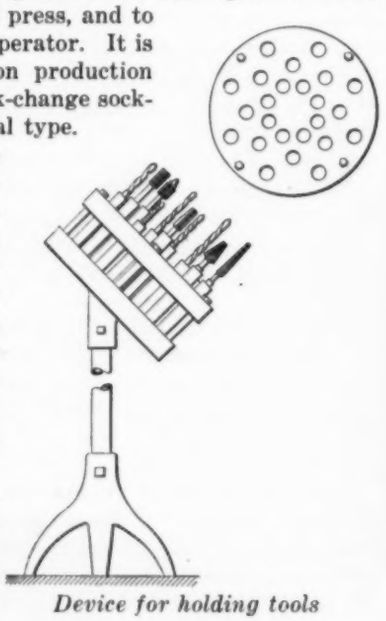
Block for tap and drill sets

Floor Stand for Drill-Press Tools

By H. L. Wheeler

The floor stand shown in the illustration was designed as a convenient arrangement for holding the various tools used in the drill press, and to save the time of the operator. It is of particular value on production work for holding quick-change sockets of the conventional type.

The holes in the top plate are bored slightly larger than the diameter of the socket used on the machine. Any number of holes may be bored, although eighteen or twenty should be sufficient for the average job. The stand will hold several sizes of drills, reamers, counterbores, tapper chucks, etc. It keeps the tools all in one place and in a convenient position for the operator on piece or bonus work, where every minute counts.



Device for holding tools

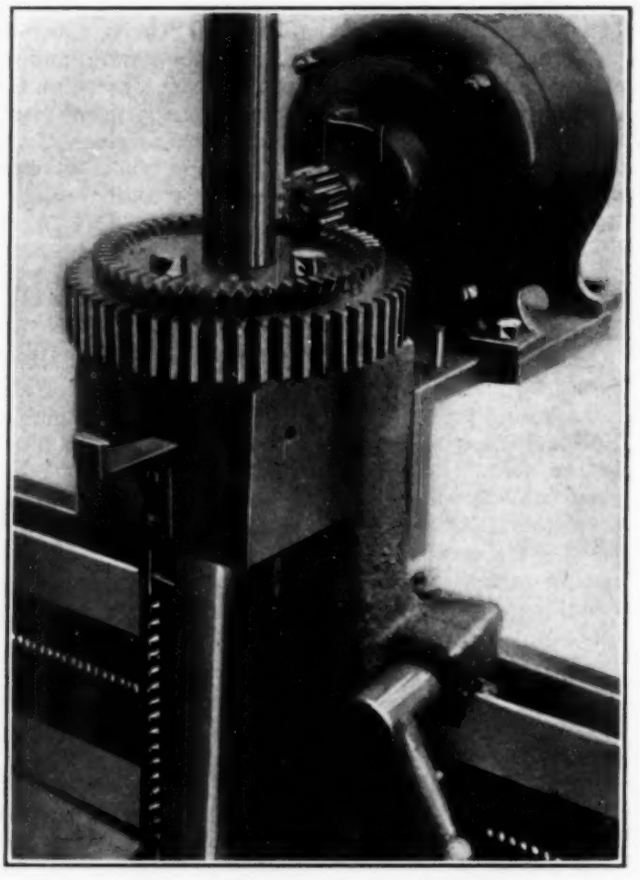
The top plate may be made of steel or cast iron and should be secured to the bottom plate, or casting, by means of four studs with pipe spacers between the plates. The upright consists of a short piece of pipe or cold-rolled shafting, connecting the base with the top. If desired, a standard pipe flange may be used in place of the bottom casting.

Improvised Motor Drive for Drilling Machine

By Milton Wright

The illustration shows a Canedy-Otto radial drilling machine that formerly was driven by belt, but which is now provided with direct motor drive.

The spur gear is a part of the original machine, being allowed to remain as a convenient means of at-



Motor drive for small radial drill

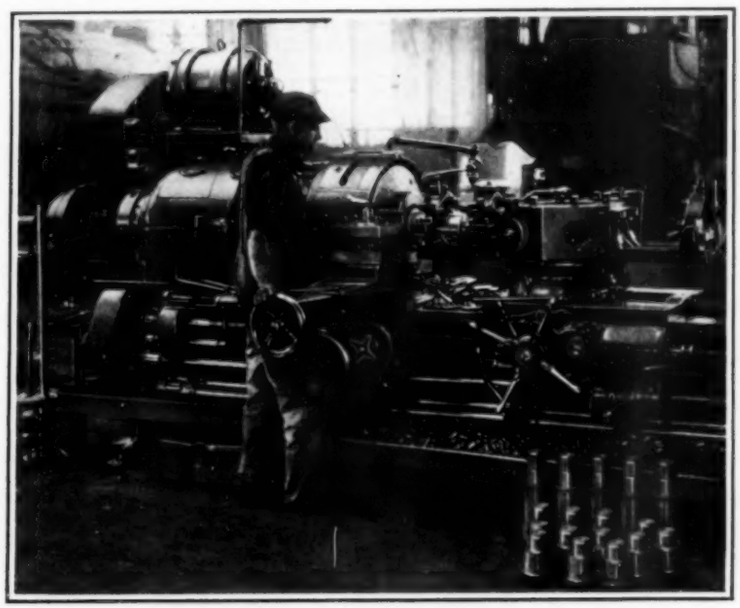
taching the crown gear that now derives its motion from the pinion on the motor shaft. A bracket bolted to the head of the machine furnishes a shelf for the motor, which is of about ¼ horse power.

A pot-shaped casting—a regular part of a Fellows gear shaper—is inverted over the gears, completely enclosing them when the machine is in service. The improvisation was made in the shops of the Fellows Gear Shaper Co., which accounts for the nature of the guard. The crown gear and pinion were both cut on a gear shaper.

A Turret Lathe in a Railroad Shop

By Chester H. Franklin

One of the uses of modern machine tools in railroad shops is shown in the illustration, which is from the Battle Creek shop of the Grand Trunk Railway System, that is now part of the Canadian National Railway. The Libby lathe shown happens to be at work on making



Making locomotive pins from old axles

crosshead pins and also knickle, or side rod pins, but is used on a large variety of work within its range, which is considerable.

The pins are being made from steel axles that have seen service under locomotive tenders, but have been turned down to the minimum diameter. Some of the pins are shown on the floor, giving an idea as to the varying sizes and kinds of pins that are made from salvaged stock. The lathe is motor driven and is well equipped with tools for the work that it handles.

End-Stamping Tool for Automatic Screw Machines

By Henry Simon

Screw machine products are at times required to have letters or numbers stamped upon the end, and in such cases it will be a decided advantage to do the stamping before the part leaves the machine. The simple tool illustrated will do this stamping in a most satisfactory manner. By its use the necessity of transferring the parts to a second-operation attachment on the machine will be avoided, and the time of stamping will be almost nil. This particular tool, while designed for B. & S. automatics, can be applied to other machines.

The tool consists of two main parts, a shank *A* adapted to be clamped in the turret hole, and a body *B* revolvable in the shank and carrying the stamping head *C*, which latter is removable and varies in shape for different jobs. The head, in addition to carrying the stamp, is also provided with means of frictionally taking hold on the part to be stamped while it is still on the bar and is made in two styles, as shown in the illustrations. The tool shown in Fig. 1 is for establishing contact with the part internally, and is used mainly for the larger parts having a hole in them, while the one shown in Fig. 2 takes hold externally, very much as does a spring collet.

Whenever possible, it will be found advisable to take hold of the part internally, as thereby the construction of the head is simplified. As Fig. 1 shows, the main part of the head *C* used in such a case consists of a bushing with a hollow and slotted stem, the stem being held in place by means of a set-screw, and in turn holding in position the friction plug *D*. The latter is made with a shank fitting in the bushing, and a head of a diameter closely fitting the hole in the part to be stamped, the forward end of the head being slotted to give a stiff, spring action.

The round-shanked stamp *E* is located in a hole in the proper position in the head *C*, and is there held frictionally, the hole into which it fits being made small enough to allow a light force fit. It should be said that the head is made from soft, cold-rolled steel, while the remaining parts should either be casehardened or made from tool steel. The only other parts of the tool are the bronze thrust-washer *H*, and end washer *I*, which latter prevents the body *B* from dropping out of the shank. The body stem should be an easy turning fit in the shank and there should be at least 0.001 in. shake between the two parts on the diameter, and about 0.010 in. end shake, since the tool will not work if there is any excess friction.

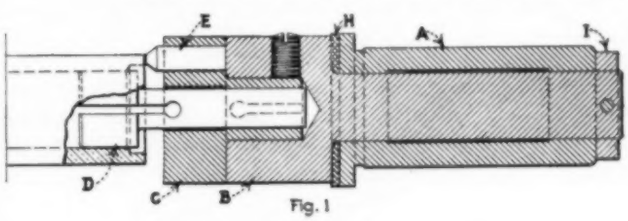


Fig. 1

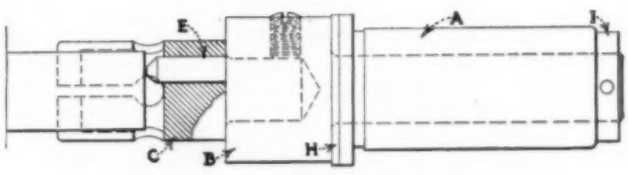


Fig. 2

Fig. 1—Stamping tool with internal grip
Fig. 2—Stamping tool with external grip

The action of the tool explains itself. The two lobes of the friction plug should be spread sufficiently to allow a firm frictional engagement of the plug in the part, just enough so that the tool can be made to turn in the part by hand.

The type of head in Fig. 2 is made smaller in diameter and consists of only one part, the external friction finger being formed upon it in a manner similar to that of an ordinary feeding finger, namely by splitting the shell part into four sections by slots ending in as many holes near the solid portion. In this case it is necessary for the head to be made from tool steel and hardened, and a force fit for the stamp is therefore not indicated. Instead, it should be soldered into the head, or else it may be held by means of a small pin passing through the head and the stem.

As a rule, it will be advisable to stamp the parts as soon after the cutting-off operation as possible, although no fixed rules can be given.

In regard to the pressure required, and what is more important, the extent and depth of the letters to be stamped, the accompanying pressures for stamping, in brass, an impression totaling 1 in. combined length of outline will be helpful.

Depth of Stamping	Pressure Required
0.003 in.	750 lb.
0.004 "	1,800 "
0.005 "	3,500 "
0.006 "	6,000 "

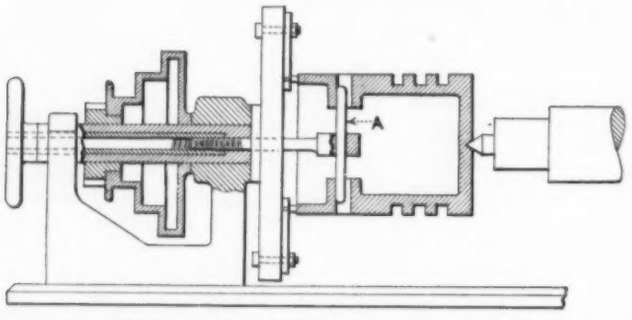
The turret pressures that should not be exceeded are approximately 250 lb. for a No. 00 machine, and 600 lb. for a No. 2 machine. It will therefore be seen that if stamping is to be done to a depth of 0.006 in. on a No. 2 machine, the total outline (at the apex) of the letters should not exceed 0.100 in. This would be equivalent to, for instance, the letter *F* 0.040 in. high by 0.040 in. wide. If it were to be stamped to a depth of 0.003 in., about eight such letters could be stamped at once. Since a good, legible impression can be made at a depth of 0.004 in. and a very fair impression at 0.003 in., it will be inadvisable to try to increase the depth of the stamping in most cases.

The figures given above are only approximate, and will vary according to the shape and character of the letters and the condition of the stamp. A dull stamp will not produce satisfactory work.

Holding Oversize Pistons for Turning

By Charles Kugler

The illustration shows a method that I saw in a small shop to hold oversize pistons for automotive engines while turning them to the desired diameter. It is much



Holding oversize pistons to turn them

better than using a chuck for the purpose as the latter is apt to distort the piston, sometimes causing spoilage.

Four pieces of flat cold-rolled steel, each having a short pin projecting from it near one end, are bolted securely to the faceplate of the lathe and a facing cut taken over the exposed ends of the pins to produce a true bearing surface. The long pin *A* is a loose fit in the head of the drawbolt, the construction of which may easily be seen in the sketch.

With a piston set in place in the lathe and the pin *A* passed through the wristpin holes of the piston and through the head of the drawbolt, the end of the skirt is drawn to a bearing upon the faced ends of the projecting pins with sufficient pressure to drive the piston against the cut, but without any tendency to distort it.

The piston can be trued up quickly by means of a dial indicator, or merely by placing a stick of wood in the toolpost and bringing it to bear lightly against the revolving piston before tightening the handwheel nut of the drawbolt. The tail center of the lathe is then brought up as a safeguard to prevent the piston from being displaced during the turning operation.

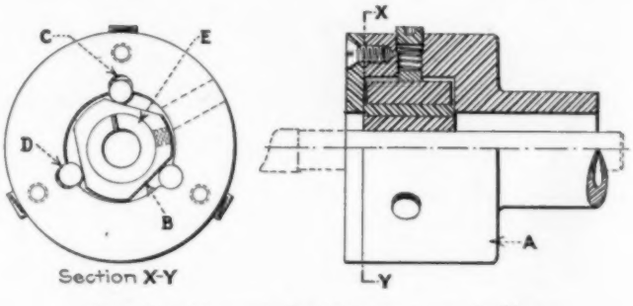
A Floating Reamer Holder

By F. W. Boeckel

In reaming work to close dimensions in the screw machine, we had trouble from the bell mouthing of the holes.

The reamer was driven by a pin through the shank in the usual manner and upon investigation we found that it was invariably out of alignment, due to its weight, at the time of entering the hole. That is the shank was below the center line. When the reamer began to cut, the torque prevented it from floating fully.

We relieved this condition by making the holder shown in the illustration. The body *A* was bored to receive the triangular piece *B*. Three holes, as at *C*, were drilled and the webs cut away so as to form



Construction of floating reamer holder

recesses opening into the base, into which pins, as at *D*, were placed. The triangular part *B* was so developed that its high parts could not pass under the pins. Part *E* is a split adapter for holding the reamer shank and is locked by a headless setscrew, accessible through a clearance hole in the body *A*.

Sufficient pressure is brought against the pins by three springs to keep the triangular block and the reamer central.

If the machine will allow, the reamer should be so located in the split bushing as to have the unsupported ends project as nearly an equal amount as possible.

The action of this device is to keep the reamer in alignment as it enters the work, drive it from three points equally spaced, and to allow full floating movement through resiliency of the springs.

Sizes of Standard Milling Cutters (Simplified Practice)

Sprocket-Wheel Cutters for Roller Chains, American Standard Tooth Forms

Circular Pitch	Diameter of Roll	Number of Teeth in Sprocket	Diameter Cutter	Width of Cutter	Size of Hole
⅜	0.200	6	2¾	11/32	1
		7–8	2¾	11/32	
		9–11	2¾	11/32	
		12–17	2¾	7/16	
		18–34	2¾	7/16	
		35 and over	2¾	11/32	
½ to ⅝	0.313	6	3	3/4	1
		7–8	3	3/4	
		9–11	3⅛	3/4	
		12–17	3⅛	3/4	
		18–34	3⅛	11/16	
		35 and over	3⅛	11/16	
⅝	0.400	6	3⅛	3/4	1
		7–8	3⅛	3/4	
		9–11	3¼	3/4	
		12–17	3¼	3/4	
		18–34	3¼	11/16	
		35 and over	3¼	11/16	
¾	0.469	6	3⅜	13/16	1
		7–8	3⅜	13/16	
		9–11	3⅜	13/16	
		12–17	3⅜	7/8	
		18–34	3⅜	13/16	
		35 and over	3⅜	13/16	
1	0.563	6	3¾	1¼	1¼
		7–8	3⅞	1¼	
		9–11	3⅞	1 1/16	
		12–17	4	1 1/16	
		18–34	4	1⅛	
		35 and over	4	1 1/16	
1 to 1¼	0.625	6	3⅞	1½	1¼
		7–8	4	1½	
		9–11	4⅛	1 13/16	
		12–17	4⅛	1 13/16	
		18–34	4¼	1 13/16	
		35 and over	4¼	1 13/16	
1¼ to 1½	0.750	6	4¼	1 13/16	1¼
		7–8	4⅜	1 13/16	
		9–11	4½	1 13/16	
		12–17	4½	1¾	
		18–34	4⅝	1 15/16	
		35 and over	4⅝	1⅞	
1½	0.875	6	4⅜	1 13/16	1¼
		7–8	4½	1 13/16	
		9–11	4⅝	1 13/16	
		12–17	4⅝	1¾	
		18–34	4¾	1 15/16	
		35 and over	4¾	1⅞	
1¾	1.000	6	5	2 3/32	1½
		7–8	5⅛	2 3/32	
		9–11	5¼	2 1/16	
		12–17	5⅜	2 3/32	
		18–34	5½	1 29/32	
		35 and over	5½	1⅞	
2	1.125	6	5⅜	2 11/32	1½
		7–8	5½	2 11/32	
		9–11	5⅝	2 5/8	
		12–17	5¾	2 1/16	
		18–34	5⅞	2¼	
		35 and over	5⅞	2 3/32	
2½	1.550	6	6⅜	3	1¾
		7–8	6⅝	3	
		9–11	6¾	2 13/32	
		12–17	6⅞	2 13/32	
		18–34	7	2¾	
		35 and over	7⅛	2 11/16	
3	1.900	6	7½	3 13/32	2
		7–8	7¾	3 13/32	
		9–11	7⅞	3 13/32	
		12–17	8	3 13/32	
		18–34	8	3 13/32	
		35 and over	8¼	3 7/32	

Angular Cutters

[Angular cutters will be furnished either right or left hand with included angle of 45, 50, 60, 70, or 80 deg.]

Diameter	Thickness	Size of Hole	Diameter	Thickness	Size of Hole
2½	½	⅞	3[1]	½	1¼
2¾	½	1			

[1] This size, 45 and 60 deg. only.

Angular Cutters, with Threaded Hole

[These cutters will be furnished either right or left hand and with either right or left hand thread. They have an included angle of 60 deg.]

Diameter	Thickness	Size of Hole	Thrds.	Diameter	Thickness	Size of Hole	Thrds.
1¼	1/16	⅜	20	1⅝	3/16	½	16

Double-Angle Cutters

[Double-angle cutters will be furnished with an included angle of either 45, 60, or 90 deg.]

Diameter	Thickness	Size of Hole	Diameter	Thickness	Size of Hole
2½	½	⅞	2¾	½	1

Cutters for Fluting Reamers

[These cutters have formed teeth and can be sharpened without changing their outline]

Cutter Number	Diameter of Reamer	Number of Teeth in Reamer	Diameter of Cutter	Size of Hole
1	⅛–⅜	6	2	1
2	⅜–½	6	2	1
3	½–⅝	6	2	1
4	⅝–¾	6–8	2¼	1
5	¾–1	8	2¼	1
6	1 1/16–1½	10	2¼	1
7	1 5/16–2⅛	12	2½	1
8	2¼–3	14	2¾	1

(Conclusion)

Punch here to suit your binder

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Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Discoloration of Polished Machine Tool Parts

Q. Please advise us what causes discoloration in the polished parts of machine tools in service and also tell us the proper material to wipe on to prevent this objectionable discoloration which does not appear to be rust.

A. Discoloration, such as you name, often results from the use of a lubricating oil which either contains some acid that corrodes the finished parts or, by evaporation, leaves upon the surface a brown or yellow coating. Such oils should be avoided.

When the normal use of the machine tool does not have the effect of keeping the finished parts oily it is a good plan to rub them with vaseline. This will materially retard the tendency toward discoloration.

Helping the Workers and Production By Group Payment

Q. We have a number of sub-assembly operations in the course of our production work in which three or four men are employed to each do a part of the work, feeding from one to another. There are times when one will hold up the others for one reason or another, and, when we have to break in a new man, we have trouble keeping up production. Payment is on the individual piecework plan. Please tell us if there is anything you can suggest that might help matters.

A. It is our opinion that your trouble can be ended by a method of group payment that has been successfully adopted in other companies. In other words you would establish a piece price per completed assembly and then make equable division to each individual on a base price plus a per cent, or on a straight per-cent plan.

One company we know of tried this plan and not only increased the productivity of the group as a whole but also cut the average "breaking in" time from two weeks to but two days.

In the group plan there is a distinct incentive toward mutual assistance for mutual benefit that does not exist in any straight, individual, piecework system.

Welding Electrode Quality

Q. Can anything be done in the manufacture of electrodes for electric welding so that those of inferior material can be made to function as well as those of a better grade?

A. So far as the material and a large share of the value in the weld produced is concerned our answer to this question is no. Electrodes that have been ruined, however, by the inclusion of gas or those that have hydrogen, nitric acid or sulphuric acid on their surface can be made to function properly by coating them with a 50 per cent solution of lime or boron suboxide and allowing this oxide to dry.

Whenever a coating is used, the purpose should be to improve the results obtainable from good electrodes and not from the standpoint of salvaging material that would otherwise be unsuitable for use. It is a simple matter to test the material in a supply of coated electrodes by trying samples from which the coating has been removed.

Using a Hand Reamer in a Lathe

Q. I had a reaming operation to do on some cast-iron parts in a lathe. I was instructed to bore out the 1¼-in. hole to be reamed to ¼ in. small and to then ream it in a vise by hand. I bored the hole and then, instead of removing the work from the lathe, used the hand reamer rested against the dead center and held it from turning by means of the reamer wrench resting on the carriage. My foreman stopped me after I had gotten one part completed saying I would ruin the hand reamer by using it in the lathe. Please tell me why this is so.

A. It will not injure a hand reamer to use it in a lathe providing the speed is very slow and the cut is light. The ¼ in. was entirely too much to allow for the operation as 0.005 in. would have been ample.

There is danger in the set-up in a lathe, however, that the end of the reamer might get away from the tailstock center and get caught with serious consequences to both the tool and the work. This is probably the reason that your foreman stopped you.

Action and Use of the Hydraulic Prefiller

Q. Please explain the action and use of the prefiller in connection with hydraulic press work.

A. The prefiller is an attachment designed to save the water from the high-pressure lines except for the actual length of stroke necessary to perform useful work. It is particularly economical when the presses to which it is fitted are large in total water capacity per stroke.

It consists of a tank located above the press and connected through a line and valve, that can be controlled by the operator, to the press cylinders. If the ram comes down to hit, it is connected to all of the cylinders but if the ram is actuated upwards there must be at least one cylinder to which it cannot communicate since there must be a means of lifting the ram to the work.

Considering a press that acts downward, the operator opens the prefiller valve and relieves the pressure from the press "pull-back" pistons. The ram then descends by gravity, allowing the water to flow in on top of the piston from the prefiller tank. When the press bottoms on the work ready to make a "hit," the operator closes the prefiller valve and opens the valve communicating to the high-pressure water. The hit is then made, the high-pressure valve is closed, the prefiller valve is opened, the pullback pressure is applied and the ram returns to the top of its stroke. As it returns, the water in the cylinder is pushed back up to the prefiller tank the excess going back to the return line through an overflow line from the tank.

Technical Abstracts

Industrial Psychology

Lillian M. Gilbreth, of Frank B. Gilbreth, Inc., consulting engineers, considers the science and art of handling men and gives an evaluation of the successes and failures that are found. Personnel work depends on four factors: first, selecting or finding the right job for the right man; second, training the man for the job; third, securing and directing technical co-operation toward increased production; fourth, training men to function together.

An employment department must know the general type of worker that the organization desires. There must also be an intimate knowledge of the various types of work done. There must be a knowledge of the science of selecting men.

There is no better test of acquaintance or intimate knowledge of an occupation than seeing the worker in the proposed work place. The value of tests in selection has been debated from every possible angle. Mrs. Gilbreth states that in the future, more, rather than fewer, morons will be employed in industry. Better teaching in industry makes possible selecting workers of a lower type who can perform the work if they are developed to the height of their ability and who will receive permanent satisfaction both in the performance and in the wages received. —*Mechanical Engineering*, Nov., 1925, p. 1039.

Repairs by Welding

A. M. Candy, general engineer of the Westinghouse Electric & Manufacturing Co., states that there is no industrial plant in which the tools of production are subjected to more strenuous service than in a modern steel mill. There is, therefore, unusual pressure on the maintenance departments of steel mills to be always on the alert for any processes or apparatus which will enable them to expedite repairs.

By using the arc welding process, steel mill operators have found that a great many repairs, previously considered impossible, can now be made, that the cost of making numerous repairs has been materially reduced to sometimes 10 per cent of previous costs, that the time required to make various repairs has been lowered, that the life of certain repaired parts is greater than the life of the original parts and that a large number of repairs can be made on auxiliary equipment such as steam locomotives.

One of the most money-saving repair jobs received by the welding department is the steel mill driving spindle, the pods of which have rapidly become worn, in service, by the coupling box pods. The appearance of one of these spindles, before and after building up the pods, can be noted from illustrations given in the article. These spindles which, when new, cost several hundred dollars apiece, can be reclaimed for from $25 to $50 each, depending on the size. The wear on the pods is principally an abrasive action and, therefore, to obtain the maximum life, it has been found that a deposit of high manganese steel properly quenched gives the best results. When the pods are badly worn, low carbon steel is used as a base and the high manganese material is used only for the last ½ in. to ¾ in. layer. In many cases it has been found that pods built up in this manner will outwear the original steel casting.

To carry on welding operations in a steel plant it is usually advisable to establish a central welding department where a majority of the work can be brought for repair. For such an installation one or more motor generators of the multiple-operator type of about 500 or 1,000 amp. in capacity at 60 volts are usually used. This equipment, with proper control panels, will provide welding current for a number of operators working from a single machine. Where it is necessary to take the welding equipment to the work a multiple-operator portable set can be used for capacities of from 300 to 500 amp.

If only sufficient capacity for an individual operator is necessary, the portable single-operator type of equipment can be used. When equipment of an unusually light weight is desired and where direct-current service is available at from 500 to 600 volts, a resistance welder that weighs 160 lb. and can be carried by two men, can be employed, and if the direct current service is 230 to 275 volts, a much lighter equipment, weighing 60 lb. can be used, this unit being carried by the operator.—*Iron Age*, Nov. 12, p. 1307.

Belting Data

That the responsibility for factory belting is usually left in the hands of employees who have received very little, if any, instruction in the correct methods of its application and care, is pointed out by W. W. Nichols. Hence, belts of too light weight are often installed and are put on at an excessive tension. As a result the pulley bearings wear excessively, and there is an unnecessary loss of production while these bearings are being repaired.

The buyer of belts often considers mainly the original cost of the belt rather than the duty which it is required to perform, and generally buys the lowest priced article on the market. The use of heavier weight belts from the main shaft to the countershaft is an improvement needed in many plants. Another improvement is the use of proper roller shifter forks by which a material saving can be effected.

Mr. Nichols was called in consultation by one of the large automobile manufacturing companies in America to assist in making a belt survey in their plant. He suggested using an electric recording watt-meter to obtain diagrams of the actual power consumed upon various types of machine tools and ascertaining the cubic inches of metal removed per minute per watt, this data to be tabulated for future reference and use when similar classes of work are in progress.

Diagrams are shown, in the article, which were taken from a punch press, a Norton grinder, grinding cam shafts, and a boring mill during this study. These diagrams furnish the best possible method of checking previous time studies, as well as for showing the friction load of the machines when running idle.—*Management in Manufacturing*, November, 1925, p. 259.

American Machinist

KENNETH H. CONDIT AND FRED H. COLVIN
Editors

Established 1877

Automobile Industry Borrows Little

BORROWED capital plays but a small part in the conduct of the automobile industry, for, according to the last report of the National Automobile Chamber of Commerce, over 88 per cent of the business is conducted on capital owned by the companies themselves. This is a higher percentage than is found in most industries. Long term borrowing is only 1.7 per cent as against 22.5 per cent of the steel industry. There is an inventory turnover 6.3 times a year, a turnover of receivables every 23 days and of total assets, 1.2 times a year.

These figures are encouraging for a continuation of good business, the only danger being overproduction. Those who deal with automotive shops should feel fairly certain of a good market for 1926.

There is a lesson for other industries in these prosperity figures. For, aside from the fact of phenomenal demand for automobiles, this industry has led the way in introducing the most modern equipment, even when it meant scrapping machines that were comparatively new, but that were less productive than those of latest design. The automotive industry is a shining example of how modernizing equipment pays.

Its success should also make it fully appreciate the part that machine tools have played in placing it in such an enviable position.

Monopolies

FOR three centuries the Anglo-Saxon has been instinctively opposed to monopolies. Different generations chose different ways of expressing their antipathy. In the good old days when direct action was in vogue, it was not uncommon for monopolies to vanish by the sword. Now, we claim to be more civilized and our actions, thanks to our common and statute laws and those who make their living by interpreting them, are seldom anything but indirect.

The old instinctive suspicion is still there, however, as witness the Sherman Act, the Clayton Act and the Federal Trade Commission Act. Trust busting as a favorite indoor sport still has its devotees.

Only very recently have we awakened to the fact that there are certain natural monopolies that should be maintained as such and subjected to regulation to keep them within bounds. Among them are the telephone, transportation means of various kinds, water supply, and gas and electric light and power services.

The danger, of course, is that those natural monopolies will be over-regulated, as some of them have been. But better a short period of too much regulation than that destructive competition should wipe out the services altogether. When we decide which are the monopolies that should be maintained and regulated, and discover how to regulate them efficiently we shall have done much to eliminate existing wastes.

Bucking Economic Laws

FIXED ideas and a huge bank account do not always make a desirable combination. Both may easily tend to prevent the adoption of new ideas that are in the line of economic progress.

Suppose, for example, that the chief engineer of a large plant had the fixed idea that a certain type of conveyor was best and could not be convinced to the contrary, and that when shown figures by engineers of another type of conveyor, as to the savings that could be guaranteed by the makers of a newer type of apparatus, the reply was "We don't care what the cost is—we like this type and we will not have any other."

There comes a time in most concerns when such an attitude either wrecks the firm or cripples it by allowing smaller competitors, who are not blessed (?) with so much money, to undersell them on account of having more economical equipment. More often, however, the engineer who makes the sort of statement quoted finds that some one of the "powers that be" have become wise to his attitude and he is hunting a job long before the firm gets to a dangerous condition.

No individual or company is large enough to buck the laws of economics for any length of time by letting personal whims stand in the way of progress. No business is rich enough to waste money indefinitely. The best equipment and the best management are necessary for continued success.

Just Suppose

JUST suppose that your inventory showed a minimum profit for 1925. That upon analysis all departments but one reflected good earnings. That investigations showed the backward department might have done much better if it had possessed modern equipment.

Do you think it fair to the sustaining departments and directors to carry on during the coming year under the same handicap?

Just Suppose.

Shop Equipment News

Hutto Large-Bore Grinders

The Hutto Engineering Co., 515 Lycaste Ave., Detroit, Mich., has constructed the machine illustrated in Fig. 1 for wet grinding large-bore cylinders. The grinder illustrated in Fig. 2 is used for the work.

The grinder is of a double-end or tandem type. The tool consists of a central driving member with a set of six stones at each end. The over-all length of the tool is less than half the length of the bore, so that there will be an overlapping of the stone travel of the two ends.

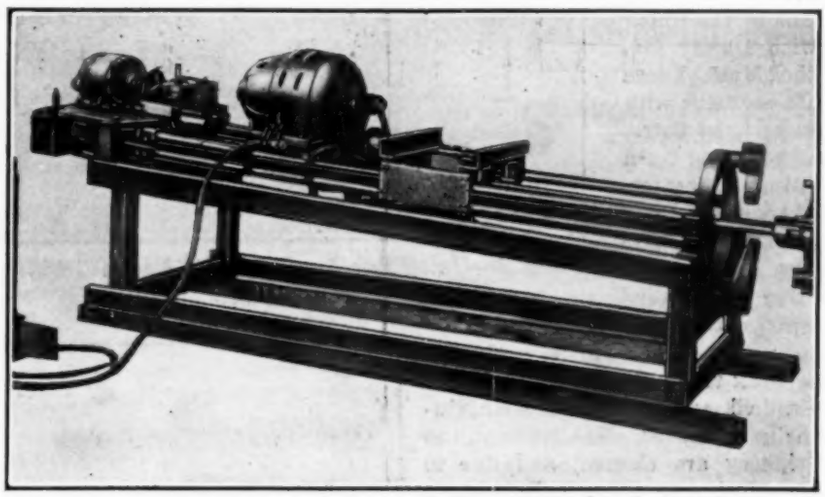


Fig. 1—Hutto Portable Grinding Machine

Each stone is 6 in. in length and is set in die-cast metal holders arranged radially and equidistant from each other. The holders each have two pins faced and resting against two internal opposing adjustable cones. They are held in close contact with the cones by means of two endless coiled springs passing over the two grooved ends of bars which, in turn, pass through each pair of stone-holder pins.

Turning the cone-adjusting screw either draws the cones toward each other, thus forcing apart the stones against the wall of the cylinder bore, or allows them to back away from the wall under pressure of the springs. The setting of the stones is positive, so that prescribed limits can be adhered to. Independent or simultaneous adjustment of each set is possible.

In operation, when the grinder has neared the drive end of the work after a cut, the machine is stopped so that the adjusting screw can be turned and pressure against the wall removed. In this way, the chances of scratching the surface are reduced when withdrawing the grinder from the work. The stones can be dressed with the edge of a file or dressing stick in order to remove the glaze. Kerosene is used as a coolant.

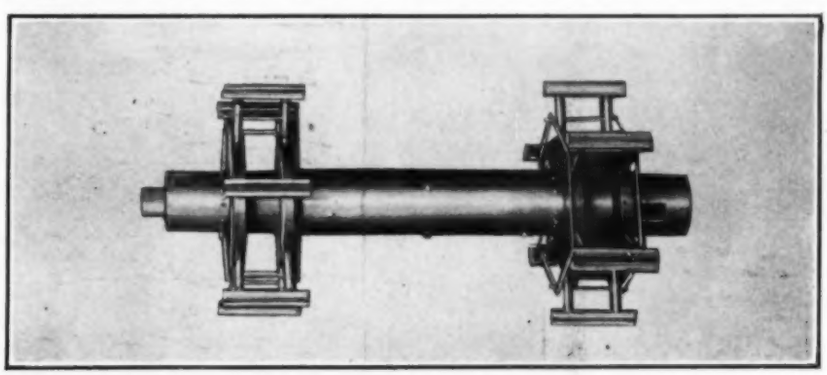


Fig. 2—Tandem large-bore grinder

The machine illustrated in Fig. 1 is suited for use in engine-building or locomotive repair shops, where it can be attached directly to the cylinder or piston valve chamber to be ground. The two clamping feet can be seen at the right-hand end of the machine. The feet are mounted on heavy pins or studs and can be swung inward for work smaller than the end ring casting or outward for larger work. The equipment can be mounted on a truck so that it will be easily portable.

A Triumph, three-phase, 5-hp. motor is used to rotate the grinder. A chain connects the motor to the transmission driving gear. Four speeds are provided in the transmission box, which can be seen mounted to the right of the motor on the main guide rods. At the left-hand end of the machine is mounted the control switch.

The small motor at the end of the machine is a Howell, reversible, three-phase, 1-hp. unit used for feeding the grinder in and out of the cylinder. It is connected by means of a flexible coupling to a speed reducer with a ratio of 20 to 1. On the lower end of the reducer shaft is mounted a spur pinion that meshes with a rack on the shaft. To this is attached the framework carrying the driving motor and transmission. They are made to travel back and forth as a unit.

In order to compensate for lack of alignment between the machine and the work, a Spicer universal joint is provided at the transmission end of the drive shaft and a ball-and-pinion type of joint on the end carrying the grinder.

The machine is shown mounted on a tilted frame so that when the work is approximately aligned with the machine, the flow of kerosene or coolant will be rapid and carry off the abrasive particles.

Shop Equipment News

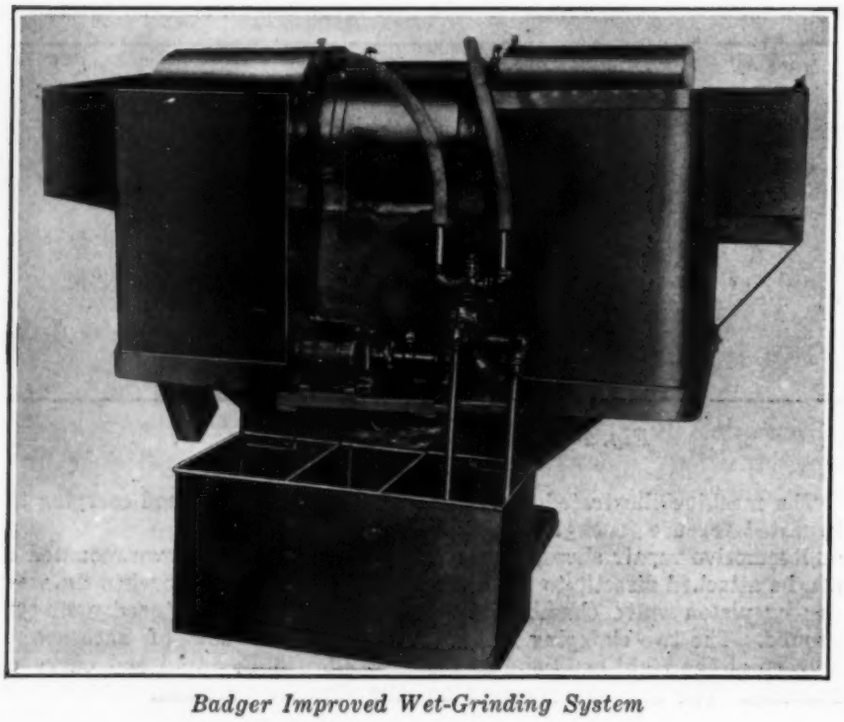
Badger Improved Wet-Grinding System

The illustration shows a built-in type of motor-driven grinder, made by the Badger Tool Co., Beloit, Wis., and equipped with this company's improved wet-grinding system. The view is taken from the rear of their No. 4 machine, a belt-driven model of which was previously described on page 748, Vol. 52 of the *American Machinist*.

The saddles which carry the oscillating lever feed tables are supported on planed ways at both ends of the machine. Cast-iron water pans are attached to the pedestal directly beneath the finished ways and form a basin into which the coolant falls. It is drained off to the settling tank which can be seen in the foreground of the illustration, through cored openings in the pedestal.

The reinforced sheet metal guards and shields are shaped so as to completely inclose all the moving or working parts of the machine but allow full operating clearance for the tables and the cylinder wheels which are 14 in. in diameter.

A "Fulflo" pump is mounted on the pedestal above the settling tank. It is driven through a flexible coupling from a small electric motor which can be seen to the left. Piping is provided from the tank to the pump and hose from the pump to the two grinding wheels. A valve at the pump and one at each wheel are provided for regulating the flow of coolant.



Badger Improved Wet-Grinding System

Union Two-Lip End Mills Spiral Cut

A line of two-lip end mills has been made available with either straight or taper shank by the Union Twist Drill Co., Athol, Mass. These mills are made with two spiral flutes, and with end teeth cutting to center, and are used largely for milling keyways.

Due to the end teeth cutting to center, these mills can be sunk into the work the required depth similar to a drill, and are then fed longitudinally as needed. The teeth on the periphery are cleared, and due to the spiral cut, these mills give a smooth shearing action, and the end teeth are enabled to get under the chip.

These mills are made of high-speed steel, and with the hand of the spiral made the same as hand of cut; i.e., right hand spiral for right hand cut; left hand spiral for left hand cut.

They are made with straight or taper shank, and in all standard sizes.

They are carefully heat-treated to obtain the proper degree of hardness, and at the same time, have the necessary toughness so that the corners of the teeth will stand up to the maximum work without dulling or crumbling.

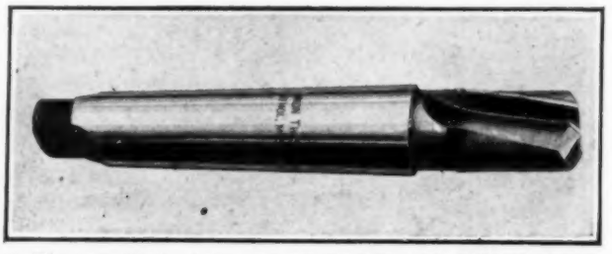


Fig. 1—Union Two-Lip Spiral-Cut End Mill with Taper Shank

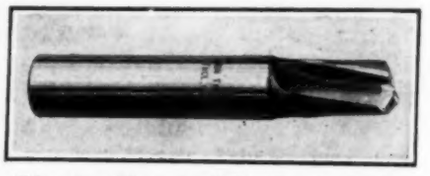


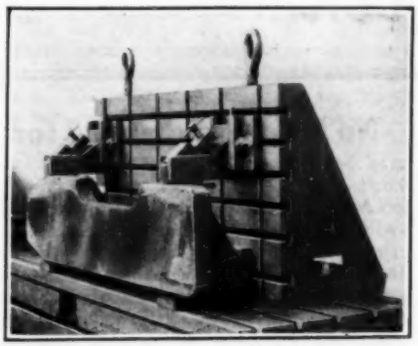
Fig. 2—The straight-shank design

Diamond Grinder Work-Holding Fixture

The Diamond Machine Co., Providence, R. I., is manufacturing the work-holding fixture illustrated, designed by one of its customers for use on its face-grinding machines such as those previously described on page 583, Vol. 39, and on page 155, Vol. 60, of the *American Machinist*. The fixture is intended to accommodate a wide range of miscellaneous work of various sizes and irregular shapes without the use of auxiliary clamps, bolts or blocks.

The fixture comprises an angle plate in which T-slots have been machined vertically and horizontally, and four clamping members that can be adjusted in the slots to the desired position. The two lower members are equipped with hardened, serrated, plates upon which the work is clamped from above. Stop screws are provided for work to be ground on one side only. Adjustable posi-

Shop Equipment News



Diamond Grinder Work-Holding Fixture

tive stops are also provided for use when grinding the second side of straight work.

The two upper members have a fulcrumed clamping lever actuated by means of a jack screw that has a pin through the head. In each lever is inserted a self-aligning clamping jaw. The jaw, like the lower members, is hardened and serrated. These clamping members are also provided with stopscrews and adjustable positive stops.

The adjustable stops and the stop plungers are made from rustless steel and operate in bronze bushings.

Carroll & Jamieson Motor-Driven Lathe, 15- and 16-Inch

The Carroll & Jamieson Machine Tool Co., Batavia, Ohio, is providing its 15- and 16-in. lathes with motor drive. The belt-driven models were previously described on page 522, Vol. 63, of the *American Machinist*.

The motor is housed in a cabinet leg or base at the headstock end of the machine. The drive from the motor to the lathe is through a belt. A 2-hp., 850 r.p.m. motor, controlled by a snap switch, is used. In all other respects these machines are similar in design and construction to the belt-driven models.

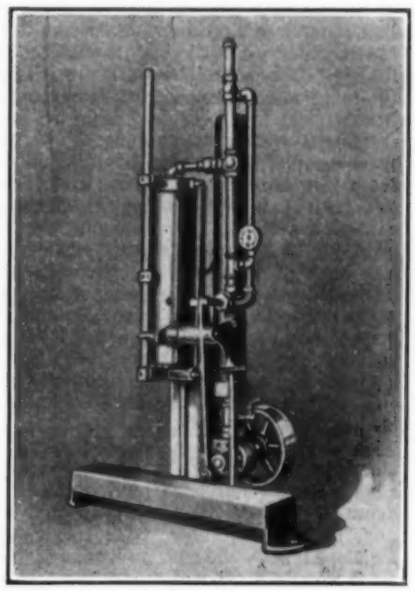
American Hydraulic Bench Broach Press

The hydraulic bench broach press illustrated is manufactured by the American Broach & Machine Co., Ann Arbor, Mich., for such operations as broaching, assembling, bushing, pressing and general operations requiring a small press with a capacity up to two tons pressure.

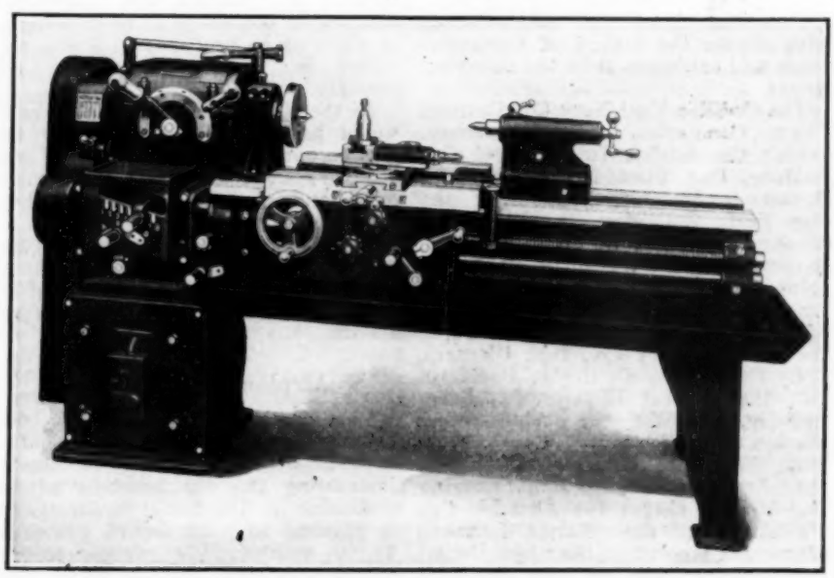
The machine has a cylinder 4 in. in diam. and made from gray iron. The piston is of a conventional design and the oil is pumped directly over its full area. The pump is of the continuous flow type, and when the machine is not in operation the oil is by-passed from the controlling valve into a reservoir above the pump. The return stroke is secured from two springs that operate automatically.

The machine has a relief valve, allowing a pressure to be exerted up to 400 lb. per sq.in., although it is capable of 600 lb. A safety relief valve can be set for any maximum pressure within the capacity of the machine. The drive pulley is 10 in. in diam. and has a 3-in. face. The gage provided is graduated in pounds and tons up to two tons.

The longest stroke of the press is 13 in., and it can be set to shorter lengths as desired. The diameter of the ram is 2 in. and the bore in the table is 2½ in. The weight of the machine is 373 lb. The illustration shows the machine equipped with an auxiliary table 6x24 in., intended especially for straightening work.



American Hydraulic Bench Broach Press



Carroll & Jamieson Motor-Driven Lathe, 15- and 16-Inch

Reading Uses Track Laying Machine

A machine that lays from sixty to eighty-five steel rails in an hour and displaces a railroad gang of twenty-four men, is at work on the Bethlehem branch of the Reading Railway. The machine, commercially known as the "Burro," is mounted on a standard gage truck and is self-propelling to a speed of fifteen miles an hour. It is driven by a gasoline engine which also operates the boom and cables. The crew consists of a craneman and three laborers.

Other features of rail laying are similar to the ordinary hand methods. After the removal of the worn rail all spike holes are plugged and new plates applied. The rail is put into place and the machine then proceeds over the rail just laid to the next open joint on the opposite side. Eight minutes are required to move the machine from the tracks.

News of the Week

American Exports Gained Last Year

An increasing demand for American merchandise in the principal markets of the world is shown in an analysis of this country's foreign trade for the first nine months of 1925, just made by the Foreign Commerce Department of the Chamber of Commerce of the United States.

"Every continent except Asia," the report says, "increased its purchases from this country during the first three quarters of 1925 as compared with the same period of 1924. Europe with a gain of 16 per cent accounted for 52 per cent of our total exports. South America led the increases among the continents with a 30 per cent gain. Asia's buying fell 13 per cent below that of the 1924 level but indicated a decided improvement over the 21 per cent loss at the end of the second quarter of 1925."

Of seventy-six principal markets for the first three quarters of 1925, sixty-three showed increased buying over the same period of 1924. Great Britain, our leading customer, with total purchases of $668,964,000, one-fifth of our total exports, also headed the dollar gains with an increase of $85,716,000 over the first three quarters of 1924. Forty-seven per cent of this gain was due to increased purchases of cotton, which were $40,671,000 greater than those of January-September, 1924.

The import side of the story would indicate that the United States is increasing her purchases abroad at an even more rapid rate than her sales. During the first nine months of 1925 our imports amounted to $3,079,555,000—a gain of 15 per cent over the $2,669,871,000 for the same period of 1924. A large share of this gain was due to increased purchases of crude materials for our domestic industries.

McGraw-Hill Takes Over Keystone Catalogs

The McGraw-Hill Co., Inc., has bought the Keystone Consolidated Publishing Co., of Pittsburgh, Pa., and thereby acquires the two Keystone mining catalogs, the coal catalog, the mining and quarrying directories and the list services published and conducted by the Keystone company.

There is thus brought into one organization the outstanding publishing interests serving the mining field—the McGraw-Hill Co., with its magazines, *Coal Age* and *Engineering and Mining Journal-Press* and the Keystone company with its catalogs, directories and lists. *Coal Age* and *Engineering and Mining Journal-Press* have served the mining industries for more than two generations and the purchase of the Keystone property will enable them to broaden and intensify that service and assist, even more than in the past, in the solution of the problems of these industries. At the same time there is offered to the manufacturers who make the machinery, tools and supplies with which the industry does its work, a co-ordinated service, consisting of educational and creative advertising in the magazines, efficient catalog distribution through the Keystone catalogs and direct-by-mail effort through the list service.

The Keystone Catalogs, published annually, are condensed and consolidated catalogs of manufacturers selling to the mining and quarrying fields and give in convenient form the essential facts regarding the machinery and other supplies made by these manufacturers.

Joseph J. Vigneau, founder of the Keystone company and until now its president, will continue in charge of the Keystone business for the McGraw-Hill Co. with offices in Pittsburgh. Ralph C. Becker, vice-president of the Keystone company, will continue in charge of sales with headquarters in New York. Except for the retirement of Edward B. Day, New York representative, who leaves to devote his entire time to his company, the Hydrotator Co., New York, there will be no changes in the staff of the Keystone organization. All communications should continue to be addressed to the Keystone Consolidated Publishing Co., 800 Penn Ave., Pittsburgh.

Cards and Calendars Received

American Machinist acknowledges with thanks the receipt of Christmas cards and calendars from the following firms:

The Cadillac Machinery Co., Detroit; Chase Companies, Inc., Waterbury, Conn.; the Anchor Drawn Steel Co., Latrobe, Pa.; Stan. Spacek, Prague; Brown & Jortman, Pittsburgh; the Bay State Stamping Co., Worcester, Mass.; the Franklin Die Casting Co., Syracuse, N. Y.; the Blood Bros. Machine Co., Allegan, Mich.; E. C. Atkins & Co., Indianapolis; the Bureau of Information Pro-Espana, New York; the F. X. Cooper Co., Inc., Glenarm, Md.; the Barnes Drill Co., Rockford, Ill.; the General Electric Co., Schenectady, N. Y.; the Whitman & Barnes Manufacturing Co., Akron, Ohio; William K. Stamets, Cleveland; the New Departure Manufacturing Co., Bristol, Conn.; the Abrasive Co., Philadelphia; the Norma-Hoffmann Bearings Corporation, Stamford, Conn.; the Benjamin Electric Mfg. Co., Chicago; Battey & Kipp, Inc., Chicago.

No Hearings Planned for New Metric Bill

Announcement that early hearings will be held on the bill providing for the use of the metric system of weights and measures in the United States seems to have been unauthorized. Representative Perkins, of New Jersey, has been in Panama on official business since shortly after the convening of Congress. The clerk of his committee, Coinage, Weights and Measures, knows of no plan for hearings.

The metric bill as introduced at this session of Congress is much less drastic than its predecessors. The first metric bills provided for the use of the French system for all purposes. Under the present bill the use of metric units would be compulsory in limited degree only. Even then the metric nomenclature would be changed so that the meter would be known as the world yard and the liter as the world quart, while 500 grams would become the world pound.

The compulsory use of the system would begin nine years hence, to wit, Jan. 1, 1935, and would be limited to postal, customs and excise transactions of the federal government. That phase of the bill, it is pointed out, by its opponents, is calculated to be unpopular with the newspapers and other publications, as they would have to convert into metric terms their extensive reports as to the relative number of inches of advertising and reading matter carried.

In general, buying and selling of goods and in connection with transportation, official permission must be secured to continue the use of the present system of weights and measures. Nothing in the bill is to be understood as applying to production. Tools, machines or parts of machines are exempted by name.

As the bill is altered the metric units would have to be used only by importers, and by the Post Office and Treasury Departments of the government and those dealing with those departments.

As this is written the metric bill has not been introduced in the Senate. At the last session it was sponsored by the late Senator Ladd, of North Dakota.

Airplanes for Middies

The Secretary of the Navy has asked for an additional appropriation of $340,000 for airplanes for use in instructing the 409 members of the 1926 class at the Naval Academy. It is planned to purchase 16 planes at $8,000 each and 24 engines to cost $6,000 each. The spare parts for these engines and planes will cost $68,000.

Rickenbacker to Build Airplane Motors in Detroit

By the first of March the third airplane motor manufacturing company will be in quantity production in Detroit, Eddie Rickenbacker of the Rickenbacker Motor Car Co., has announced. Rickenbacker motors will be made in a factory on Lonyo Road near the Michigan Terminal R.R., to which the experimental section of the motor manufacturing staff is moving.

"Seven manufacturers of planes are designing planes around the motor," Captain Rickenbacker says. "We believe by the time we are ready to manufacture on a large scale the demand will keep us busy. Our tests have shown the engine will draw a one-seater scout plane at about 120 miles an hour, a two-seater "tourabout" at about 100 miles an hour and a three-seater at about 90 or 100 miles an hour."

Within ten years the aviation industry will have caused a growth of Detroit to a population of 3,000,000, Captain Rickenbacker believes, and within 25 years the aviation industry will be easily the largest in the world. In that age the "superman" pilots of planes will be as insignificant as the automobile driver of today is, and will not be as highly regarded by the public as they are today.

British Tool Builders Invite Americans

The secretary of the British Machine Tool Trades Association has written to the National Machine Tool Builders' Association extending an invitation to American manufacturers to attend the annual dinner of his organization which will be held at the Trocadero Restaurant, Piccadilly Circus, London, England, on Wednesday, March 24. The British association asks for the names of any American machine tool manufacturers who plan to be in London at that time, so that invitations may be sent to them. Sir Alfred Herbert, K.B.E., president of the British association, will preside at the dinner.

German Machinery Sold in France

According to a recent article in a French industrial magazine the exposition of German agricultural machinery, held recently at Lille, met with unexpected success and accounted for the sale of approximately 60,000,000 francs worth of German machinery in the Department of Nord as reparations in kind.

The effect of such a policy, both present and future, upon the manufacture and sale of French agricultural machinery in the north of France is causing considerable dissatisfaction among French manufacturers.

This fear is predicated on the fact that if similar sales take place in other centers of France, as is now planned, a total sale of 150,000,000 francs worth of German machinery is looked for.

The French manufacturers claim that the use of foreign machinery is fraught with danger. Dissatisfaction has already been expressed in certain sections owing to the difficulty of obtaining extra parts. An attempt is already being made to answer this objection by the establishment of a branch of a German factory at Senlis, France.

Conference on Industrial Relations in June

Tentative plans for a three-weeks conference in June on questions involving employer and employee have been prepared by the Industrial Relations Committee of the Philadelphia Chamber of Commerce. William H. Barr, president of the National Founders Association, Morris E. Leeds, president of the Metal Manufacturers Association, and Theodore H. Davis, representing the Shop Craft Association, of the Pennsylvania Railroad Co. are among those who have given their assent to the proposal, while Joseph Richie, representing the American Federation of Labor, will join in the movement as the spokesman for industrial employees.

Leaders in industry in Philadelphia agreed to the plan at a luncheon at the Bellevue-Stratford. Following the presentation of the suggestion by the Chamber of Commerce Committee, it was agreed that Ernest T. Trigg, chairman of the Industrial Relations Committee, appoint a committee to work out the details. The conference probably will be held shortly after the opening of the Sesqui-Centennial International Exposition.

One of the unique features of the meeting at which the conference was decided upon, were the speeches by James A. Emery, counsel for the National Association of Manufacturers, and that of Mr. Richie, of the American Federation of Labor, who represent opposite views of the industrial relations problem. Both agreed that a conference such as is proposed, would very greatly benefit both sides.

Mr. Richie told the committee "The American Federation of Labor will go in company with any project that seeks to improve the conditions at present existing between employer and employee."

Arthur Nash, of Cincinnati, known as "Golden Rule Nash," because he recently turned over a large portion of his business to his employees, has given his approval to the conference, and has asked that labor be represented as fully as capital.

Draftsmen Needed

The United States Civil Service Commission states that there is immediate need for design, detail, and copyist draftsmen for work at the New York Navy Yard. Increased rates of pay are in effect.

The commandant can make use of a number of mechanical draftsmen, structural-steel draftsmen, ship-piping or ship-ventilation draftsmen. Applicants will not be assembled for written tests.

Engineers Sponsor Proposed Department of Public Works

Committees of engineers, with a total membership of nearly 1,000, are being organized in every state by the American Engineering Council to carry on a nation-wide movement for the reorganization of the Department of the Interior, it is announced by the president of the Council, former Governor James Hartness of Vermont.

The engineers ask that the name of the department be changed to the "Department of Public Works and Domain." They recommend drastic changes in the distribution of administrative functions "so that the enormous public works activities of the Government, involving the expenditure of many millions annually, may be effectively co-ordinated, efficiency promoted, and waste wiped out."

The Engineering Council is embodying its proposal in a bill to be introduced in Congress in the near future by Senator Wesley L. Jones, of Washington, and Representative Adam M. Wyant, of Pennsylvania.

Under the reorganization scheme advocated by the engineers, the Bureau of Public Roads, now in the Department of Agriculture, and the Office of the Supervising Architect, now in the Treasury Department, would be transferred to the new department.

The Rivers and Harbors Improvements, Mississippi River Commission and California Debris Commission, at present under the jurisdiction of the War Department, would go to the new department together with the Office of Buildings and Grounds, District of Columbia; the Superintendent of the State, War and Navy Department Buildings, the Rock Creek and Potomac Parkway Commission, and the Office of the Architect of the Capitol. The Board of Road Commissioners for Alaska would be abolished and its duties performed by the Secretary of Public Works and Domain.

One interesting feature of the bill is a provision that the engineering officers of the United States Army may be detailed by the Secretary of War to non-military duties having to do with river and harbor improvements, the Mississippi River Commission, the California Debris Commission, or other civil functions with the approval of the Secretary of Public Works and Domain.

The engineers hope to effect a complete reshaping of the Department of the Interior during the year 1926. The present effort is a continuation of the work of the National Public Works Department Association, begun in 1919.

Passage of the Jones-Wyant measure will create a Department "under which the major public works functions will be consolidated and conducted according to the well settled precepts of a modern industrial organization."

The public works plan was publicly discussed at the annual meeting of the American Engineering Council held in Washington, D. C., for three days beginning Jan. 13. The council's committee on Government Reorganization presented a report.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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WHAT was feared and expected has at last occurred. The Federal Reserve Bank of New York has raised its rediscount rate to 4 per cent. The advance was announced on last Thursday afternoon, and while the speculative markets were somewhat tremulous on Friday morning, it cannot be said that they were much affected. Four per cent is not, after all, a high rate. It was made effective at all the other Reserve Banks some weeks ago, and the action of the New York institution would soon be forgotten, were it not that the advance was ordered in the face of a weekly statement of the reserve system that showed a gain of 2.9 per cent in the reserve ratio of the banks as a whole and a rise of 7.4 per cent in that of the New York Bank. As these gains were plainly due to an increase of $40,000,000 in the total gold held, a reduction of $56,000,000 in bills discounted, and a decrease of $83,000,000 in the aggregate of circulation and deposits, the action of the New York Bank is generally attributed to some ulterior motive, of which the public is unaware.

As Montagu Norman, the astute and uncommunicative Governor of the Bank of England, has been in this country for some weeks and was only recently at Washington, there is a disposition to assume that the Federal reserve officials advanced the New York rate in pursuance of an understanding with the British bank, and it must be admitted that this assumption finds some warrant in the statement given out through the Associated Press upon the eve of Mr. Norman's departure for London.

This statement said that "among the subjects discussed by Mr. Norman with Governor Strong of the New York Reserve Bank, one of the foremost was the policy of extending further the policy of co-operation between the Central Banks of the United States and Europe, which was initiated by the Federal Reserve Banks and the Bank of England. This joint assistance in the financial and economic rehabilitation of Germany, Belgium, Poland, and other nations is believed to have encouraged plans for carrying forward this policy through the careful use of credits or other means within their power."

This statement has led many to question the authority of the Federal Reserve Banks to use their resources for the rehabilitation of Europe, and last Thursday's advance in the rediscount rate will probably lead to a Congressional investigation of the relationship between the Central Banks of Europe and our Federal Reserve institutions. Senator King of Utah has already asked for an investigation of other phases of the Federal Reserve administration, and Congress seems entirely willing to undertake any inquiries that may be asked for.

Among those already under way are an investigation of the aluminum trust, an inquiry into the foreign control of the supply and prices of rubber, Egyptian cotton, coffee, nitrates, potash, and sisal that Secretary Hoover alleges, numerous agricultural investigations, and one or two that have to do with the tariff and the railroads. Business is pretty well hardened to this sort of thing, but it is possible that it may slacken its present rapid pace when confronted by a Congress that is so interrogative.

But no retardation is visible as yet—a calculation showing that the stocks listed on the New York Stock Exchange increased in value by about $5,000,000,000 during the year 1925, and the announcement that the 20th Century train between New York and Chicago was run in thirteen sections, on the night of Jan. 3 are news items that have been widely published as indicating the opulence and prosperity of this country.

Since New Years, most of the speculative markets have been active at advancing prices, and while wheat and coffee show some reaction as the week ends, there is no abatement of confidence in the future. The rise in coffee which was primarily due to the success of the Sao Paulo loan in London is one of the things against which Mr. Hoover protests, and it may be that the reaction in coffee as well as the decline in rubber that has carried that commodity down to 87 cents are in part due to the aggressiveness of the Secretary of Commerce in attacking the man of straw that he has set up.

Cotton is a case in point. It has been firm upon the announcement that an organized effort to reduce next year's acreage by 25 per cent will be made, and those who are well informed are commencing to figure upon an actual curtailment of at least 10 per cent.

The distributive trade of the country is commencing to recover from its usual holiday paralysis, and the demand for both cotton and woolen goods is improving. Print cloths in particular have been active and silk fabrics are being freely bought, Railroad car loadings are again breaking the record and in the industrial field, the consolidation movement seems to be gathering force.

The European situation is also better. In London, as here, the new securities offered have been readily taken and some improvement in the fiscal position of the French government is indicated by a slight rise in the value of the franc.

Taken all in all, the outlook is satisfactory, and if the anthracite coal strike is settled, as it must be soon, the only barrier in the way of increased business activity will be the fear of Congress and its investigations.

What's Doing in Industry

The first week of the New Year shows a steady progress in machine tool and machinery business. Some of the orders placed had been held up over the holidays, and many were the result of new manufacturing schedules decided upon as soon as inventories were over.

December figures proved surprising, the total volume of business in that month running close to the volume of the previous two months, which were probably the best in the year for most dealers.

Present business volume is not confined to any one locality. Detroit reports an increase in orders since the first of the year, automobile manufacturers again buying for increased production. More inquiries and a better outlook for spring business is the word from Cincinnati, while Chicago predicts that January will be as good as December in volume of sales. The automobile and farm implement manufacturers in Indiana are supplying a substantial amount of new business for Indianapolis dealers.

Conditions up through New England continue to improve, with auto accessory manufacturers buying machinery for expected factory expansions. New York dealers are doing nicely, industrialists being in the market for much equipment. Buffalo dealers express surprise at the business of the first week of the year, plenty of small orders giving a large volume when the total is considered.

The general business outlook is satisfactory, and after the settlement of the coal strike, the only barrier to continued prosperity is the fear of Congress and its investigations.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Cincinnati

A sufficient increase in orders booked and inquiries received in the past week to give more than a little encouragement, is reported by Cincinnati machine tool manufacturers and selling agents. All agree that conditions in the industry are now much better than they were at this time last year, and that the outlook is bright.

Many of the inquiries coming in are regarded as an indication that not only will a good volume of sales for replacement continue, but also that there will in the very near future be a considerable amount of buying for expansion. The latter class of inquiries is stated to be coming from all parts of the country and refers to all sizes and types of tools.

"There is nothing to indicate a cessation of the upward trend that prevailed the latter part of the year," said one leading manufacturer. "I have never seen general conditions look more favorable than they are at present," stated another. "We look for a large increase in sales in the next two or three months," said a sales agent.

Chicago

Machine tool business for the first week of 1926 has, generally speaking, justified the forecast made by dealers during the last weeks of 1925. It is still early, they say, to predict just how this month will compare with December, which was exceptionally good, but inquiries received for tools to be delivered within the next three months warrant the opinion that the volume of trade for the remainder of the winter and early spring will come up fully to expectations.

Many dealers are taking inventories. Deliveries are improving. Manufacturers of wood-working machinery, while expressing the belief that the output of wood working plants in the Middle-West will be larger this year than last, are conservative in giving their views as to just how large the increase may be. Railroad inquiries are not looked for in any considerable volume until further on in the year.

The demand for mechanics' tools and for hacksaws and band blades is brisk, manufacturers of such implements stating that the year starts out with every indication that this demand will continue, at least for the next six months.

Canada

While prospects for a gradual improvement in the machinery and machine tool business in Canada are bright, buying during the last couple of weeks has been along conservative lines.

Expanding operations in various lines of industry and the fact that considerable new work is promised for this year leads to the belief that there will be an all-round increase in business. The equipment companies are looking for extensive railroad orders. This anticipation would seem to be justified in view of the wearing out of rolling stock and the fact that orders in recent years have been below normal. Several companies have recently benefited by contracts awarded in connection with the $6,000,000 government dry-dock at Esquimalt, B. C. The contract for the new tank equipment for the Chute-a-Caron development of the Aluminium Co. of America at Chute-a-Caron, Quebec, amounting to over a quarter of a million dollars, has been awarded to the Canadian Locomotive Co. The Canadian Car and Foundry Co. has made a good start for 1926, announcement being made of an order placed with this company by the Montreal Tramways Co. for 50 cars at a cost of nearly $1,000,000.

Indianapolis

While it is too early in the New Year to foretell what will happen, the local machinery and tool trade believes that the signs are right. The last two weeks have been dull, but this is entirely due to seasonal influences. The week before and after Christmas were not entirely satisfactory, but dealers say this is to be expected.

Most inquiries come from automobile factories, both here and elsewhere in the state. The two largest local factories are preparing for a big production volume this spring. One factory has come out with a new model, and many replacements are expected before the plant gets into real production.

A good business is expected from the farm implement factories. Already the inquiries, particularly for tools, are heavy. These factories began production on a large scale on the first of the year and will continue at a high production rate until far into the summer. The machinery trade here believes this source will be productive of a good volume before spring, since many replacements are needed.

Detroit

Buyers of machine tools and machinery in the Detroit district are beginning to pick up the loose ends after the holiday season, and quite an increase in the volume of business has been noticed during the past few days over the ten day stretch which included Christmas and New Year's.

Most of the leading representatives of machinery manufacturers report a fair volume of business, which, although below that of October and November, is much better than the corresponding period last year.

From reliable sources the information comes that the Cadillac Motor Car Co. has definitely abandoned its plans for a new line of automobiles. Part of the heavier equipment needed in the manufactrue of the new line had been ordered, but the cancellation of the program was ordered before the expenditures reached anything like the figure set.

There is a general bolstering up of all weak spots in automobile plants. Machines that will not stand the gaff are being replaced by new ones, while considerable toolroom equipment is being ordered. The Ford Motor Co. is making extensive purchases for its die shops.

The Wilson Foundry and Machine Co., of Pontiac, has been buying machines for the new Willys-Overland models. The Chrysler Motor Corporation has been a heavy buyer. The engineering staff has been revamping much of the present equipment, and Chrysler, from all accounts, is about ready for a material increase in production.

The Packard Motor Car Co., it is understood in machine tool circles, is laying plans only for the new quarter, and funds are now being set aside for the purchase of new equipment which will bring every department to as high a state of mechanical perfection as is possible.

New York

There has been little or no change in conditions in this market in the past week. Business has been rather slow in starting, due probably to inventory taking and other yearly statistical work. But several substantial orders were placed in the first few days of the year, most of these having been held up over the holidays by lack of executive sanction.

The partial list is rather imposing, and portends a good volume of new business for the month. The Ingersoll-Rand Co. bought two 6-ft. radial drills and a 10-in. vertical shaper; the Great Northern R.R., a 90-in. driving wheel lathe; the Mechanical Appliance Co., of Los Angeles, a bench drill, a toolroom lathe, a hand screw machine and a two-spindle, vertical drilling machine; the Packard Automobile Co., two special milling machines for cylinder blocks; the Ford Motor Co. three milling machines; the Ellis Adding Machine Co., a bench lathe, a milling machine, a vertical drill, a turret lathe and a bench miller; the Waltham Watch Co., two 13-in. geared-head lathes and one 16-in. lathe; the International Harvester Co., two 16-in. geared-lathes and one 13-in. lathe; Goodman Bros., a 15-in. turret lathe; and the Lulting Machine Works, an 18-in. lathe.

New England

New England machinery builders move into 1926 with strong feelings of optimism, based on business already in hand and a big volume in prospect. They closed 1925 with a feeling of satisfaction, and a survey of business, especially in the last half of the year, shows comfortable profits. In general, the consensus is that 1925 business has yielded the best percentage of profit since 1922.

In Bridgeport manufacturers state that demands of the automotive industry are heavy, with prospective business awaiting the New York automobile show ending especially large, if the public sentiment is such as to warrant the placing of the business.

Waterbury and New Britain manufacturers report trade conditions are bright. Urgent requests are being received.

The Middle-West is buying automatic machinery. Railroads and the electric industry are buying. Export business is improving.

Buffalo

Machine tool dealers were pleasantly surprised by the total volume of business rolled up in December. In several instances the volume for December, usually expected to be an off month, exceeded the business written in either October or November, both of which were good months.

There was some business carried over from December to this month and the inquiries showed a pick-up in the first days of January. There was considerable business actually closed in the first week of January. Two firms reported more business closed on Jan. 5 than was closed in the entire month last year.

What is said above applies to electrical equipment also. There is, however, a lack of large orders and actually large negotiations. The business is varied and widespread, a large number of small orders making up the volume.

What the Railroads Are Doing

The Canadian National Railways have decided to convert the locomotive shops at Leaside, near Toronto, into a steel car repair shop. The conversion of the locomotive shop is due to the fact that the company has more locomotive shops than it requires while the Toronto district is at present without the proper facilities for doing steel car repair work.

Railroad equipment orders last week included the purchase of five Mikado and four Pacific type locomotives by the Gulf, Mobile & Northern from the Baldwin Locomotive Works. The Union Pacific also ordered nine 202-ton three-cylinder Overland type from the American Locomotive Works.

The Illinois Central has bought 400 freight cars each from the Pullman Co. and the American Car and Foundry Co. and is said to be inquiring for 3,000 in all. The Rock Island is in the market for 3,000 cars and the Chicago & Northwestern for 5,000. Orders for more than 20,000 cars are expected soon from a group of Western railroads.

The General Railway Signal Co. has received orders from the Lima Locomotive Works for automatic train control apparatus on 25 engines and from the American Locomotive Co. on 99 engines. All of these locomotives are for use on the New York Central lines.

The company has also received orders for electrical interlocking devices totaling 72 working levers from the Southern Pacific, the Florida East Coast and the Los Angeles & Salt Lake; also for 24 color light signals and other apparatus for the New York Central.

The Union Switch and Signal Co. has received contracts from the Southern Pacific for automatic block signal on 280 miles of line, 48 of which is double track; and for devices for interlocking the Detroit Terminal Ry. and the Detroit Street Ry.

The Mobile & Ohio R.R. Co. has applied to the Interstate Commerce Commission for permission to issue equipment trust certificates to cover the purchase of 5 Mikado type freight engines, 4 Pacific type passenger engines, 500 automobile box cars, 4 passenger coaches and 6 express cars, the total cost of which is expected to be $1,522,500.

News of the Automotive Industry

With a total production estimated at 492,000 units, the motor truck industry had, in 1925, by far its most successful year. Not only was the previous production record of 392,760 exceeded by over 100,000 trucks, but the volume of business in dollars and cents also eclipsed the previous high wholesale value of $434,168,992, established in 1918, being estimated at $500,000,000.

The Paige Detroit Motor Car Co. is running on full production schedule to fill orders for the "New-Day-Jewett" models recently introduced. The company's new factory had to be enlarged, remodeled and equipped with new machinery to handle the new line. New motor conveyors were installed, paint ovens enlarged 50 per cent and a number of other improvements and additions were made.

The Ford Motor Co. has acquired a 1,400-acre tract on the Illinois-Indiana line at Hammond, Ind., presumably for a landing field in connection with the Detroit-Chicago air line of the company.

One of the largest shipping months in the history of the Buick Motor Co. reached a climax in December with a record day of 376 carloads of Buicks shipped from the factory in Flint.

There are rumors that the Murray Body receivership may be lifted very shortly. There are definite negotiations being carried on between interests in the company and outside capital. One has for its object an outright sale of the company and other contemplates a refinancing plan.

The new Stutz vertical eight will sell at $2,995 for all models. Six body styles are offered in the line. The feature of the new car is an eight-cylinder motor with nine bearings, horsepower 92, Timken worm-drive axle and Timken hydraulic brakes. It is built very close to the ground, the height of closed cars being 70 in. from ground to roof of car. The wheelbase is 131 inches.

The new Chrysler big six will come in two wheel bases, 120 and 127 in., and the line will include six body types—roadster, phaeton, 5 and 7 passenger sedan, coupe, and a 7-passenger berline, the engine is similar to the engine of the original Chrysler, with six cylinders of 3½ by 5 in. and 288 cu.in. displacement. It produces 92 hp. at 3,000 r.p.m.

A. L. Pearce has been elected treasurer of the Peerless Motor Car Corporation.

The plant of the Revere Automobile Co., at Logansport, Ind., has been purchased by Charles H. Canode, of Chicago, representing a group of men who will form the Polaris Electric Refrigeration Co. The Revere company will be dissolved. The plant closed in 1919 when the company went into bankruptcy and for two years cars have been turned out only on order.

Personals

J. H. McDUFFEE has been appointed general sales manager of the Prest-O-Lite Co.

RALPH H. SHERRY has joined the Biflex Products Co., of Waukegan, Ill., as metallurgical engineer.

LEO K. HENNES has been elected president of the newly organized Acme Machine Products Co., of Detroit.

S. A. HARRIS has been appointed metallurgist for the Steel Improvement Forge Co., of Cleveland.

K. D. McKOLL has been appointed Canadian district manager for the United States Electrical Tool Co., of Cincinnati.

E. F. GOHL is now in charge of contracts for the McClintock-Marshall Co., of Pittsburgh, and is attached to the Los Angeles office.

THOMAS VAUGHN has been appointed a sales representative for the Pittsburgh Gear and Machine Co., of Pittsburgh. He was formerly associated with Manning, Maxwell & Moore, Inc., of New York.

FRANK W. BOWKER is now purchasing agent at Philadelphia for the Edward G. Budd Manufacturing Co. He succeeds Otto Mueller, who is now in Detroit superintending the equipping of the plant of the Budd Wheel Corporation.

F. C. HORNER has been appointed assistant to the vice-president in charge of traffic of the General Motors Corporation. Mr. Horner will be in charge of the development of the commercial motor vehicle field on steam and electric railroads.

E. J. WAGNER, formerly secretary and general manager of the Standard Gauge Steel Co., has been elected president and treasurer of the Standard Steel Specialty Co., of Beaver Falls, Pa. Alex Gilliland, president of the Duff Patents Co., of Pittsburgh, is vice-president, and J. B. Jamison, formerly district sales manager for the old Standard company, is secretary and general sales manager. S. A. Dinsmore has been appointed Western sales manager with offices at 327 S. La Salle St., Chicago.

A. S. DURANT, formerly manager of the Department of the Americas, has been made a vice-president of the International General Electric Co., in charge of commercial relations, with headquarters in New York City. JAMES C. RYAN, formerly sales manager of the Department of the Far East, has been appointed general sales manager. E. A. Baldwin, formerly manager of the Department of Europe, has been appointed manager of the Schenectady office. W. J. Edmonds, comptroller of the company with headquarters in New York, in addition to his former duties now has executive direction of the activities, with the exception of sales effort, of the International foreign sales companies.

Business Items

The Henry L. Scott Co. has been organized at Providence, R. I., to deal in machinery and engines.

The Columbus McKinnon Chain Co., of Columbus, Ohio, has been sold, Julius F. Stone being mentioned as the new owner.

The Windsor Radio Corporation has moved into a new factory and offices at 108 Washington Ave., North, Minneapolis.

Ontario Malleables, Ltd., of Oshawa, Ontario, has been acquired by a group of Toronto business men headed by Neil R. Sinclair.

Philip Cook & Sons, Inc., has been incorporated at Anderson, Ind., for the purpose of manufacturing and selling machinery and mechanical devices.

The Simplex Wire and Cable Co., of Boston, has opened a branch office in the Union Trust Building, Euclid Ave. at East 9th St., Cleveland. William H. LaMond is manager of this office.

The Motor Brake Co. has been organized and incorporated at Davenport, Iowa, to manufacture a friction brake for automobiles. Edgar C. Erickson is president of the concern.

The foundry of the Niles-Bement-Pond Co., in Philadelphia, has been purchased by Ambrose G. Warren, vice-president of the Aetna Foundry Co., of Philadelphia. The latter company will occupy the premises early in the spring.

Charles T. Main, of Boston, engineer, announces that the following men are now associated with his organization: Marcus K. Bryan, R. A. Moncrieff, F. M. Gunby, H. E. Sawtell, J. F. Osborn, W. F. Uhl, C. R. Main and A. W. Benoit.

The Barney Machinery Co., Inc., has been organized at Pittsburgh, to deal in machine tools, cranes and hoists. This company is the successor to the former Laughlin-Barney Machinery Co. Offices have been established at 483 Union Trust Bldg., Pittsburgh.

Sales representatives of the W. A. Jones Foundry and Machine Co., of Chicago, have just completed a most successful sales convention at the home offices of the company. Salesmen from New York, Buffalo, Pittsburgh, Cleveland, Cincinnati, Detroit, Milwaukee, St. Louis and Birmingham attended.

The American Car and Foundry Co. has entered the automotive field as a manufacturer of motor trucks for railroads. A corporation has been formed in Delaware, and it is understood that the company has acquired holdings in the Fageol Motors Co., and in the Hall-Scott Motor Co.

Announcement has been made of the merger of the Stuebing Truck Co., of Cincinnati, and the Cowan Truck Co., of Holyoke, Mass. The new organization will be known as the Stuebing-Cowan Co., and will continue the manufacture of hand lift trucks and platforms. Walter C. Stuebing, of Cincinnati, is president of the company.

M. A. Coolidge, of Fitchburg, Mass., has acquired all the real estate and personal property of what was formerly the Springfield Automatic Screw Machine Corporation, of Fitchburg. The property has been in the hands of trustees for about four years. The property will now be known as the Fitchburg Automatic Machine Co., and Mr. Coolidge will be the owner. B. J. Macker, who was associated with the old company, will be in active charge of the new organization, which will continue the manufacture of screw machines and equipment.

A contract has been made between the Fletcher Savings and Trust Co., of Indianapolis, and the Carle Machinery Co., of Detroit, which arranges for liquidation of the remaining property of the Haynes Automobile Co., of Kokomo. Sale of the remaining assets of the old automobile plant will begin at once. The remaining property of the company is estimated to be approximately $500,000 in value and includes six or eight buildings of the Haynes plant at Kokomo, machinery and equipment in the factory formerly used in the manufacture of automobiles, and some real estate.

Group insurance protection totaling approximately $250,000 has been established as a holiday gift for its employees by the Sidney Machine Tool Co., of Sidney, Ohio. The insurance program, which was adopted through the efforts of I. H. Thedieck, president of the company, affects about two hundred employees. Each employee receives from $1,000 to $2,500 life insurance, which will be paid to his beneficiaries in case of his death. Should he become totally and permanently disabled, however, before reaching the age of 60, he himself will receive the full amount of his insurance in monthly installments for a stipulated period.

Obituaries

JAMES L. GEDDES, former head of the Kelly-Springfield Motor Truck Co., died at his home in Springfield, Ohio, on Jan. 5. He was 69 years old.

JOHN J. HERBRECHT, for thirty years associated with the Edward Joy Co., of Syracuse, N. Y., as heating engineer, died recently at his home in Syracuse.

CHARLES E. MCFARLAN, of Cincinnati, for thirty years president of the William Powell Co., brass founders, died in that city on Jan. 3. He was 76 years old.

CHARLES E. HUGHSON, formerly a manufacturer of automobile accessories and grinding machinery in Milwaukee, died in Chicago on Dec. 30.

RICHARD E. BEBB, founder and chairman of the board of the Central Steel Co., of Massilon, Ohio, died on Jan. 5 in Canton. He was at one time president and general manager of the Canton Stamping and Enameling Co.

GEORGE E. WOOD, founder of the George E. Wood Tool Co., of Plantsville, Conn., died at the Meriden Hospital on Dec. 31, following a paralytic stroke. Mr Wood was 66 years old and had resided at Southington most of his life. As a young man he organized the tool company, which hore his name. Several years ago he disposed of the business to the Stanley Works, of New Britain.

Trade Catalogs

Bearing Metal. Topping Brothers, 159 Varick St., New York, N. Y. This company has prepared a chart listing the different sizes in which "Bearium" bushings can be had. They are made in soft, medium and hard grades. Weights for the solid and cored bars are shown.

Bearing Metal. The Cored Bar Corporation, 1543-1639 Fillmore Ave., Buffalo, N. Y., has prepared a 36-page booklet on "Sumet" cored and solid bars of bearing metal. Many illustrations are given of the application of this bearing metal. Photomicrographs show the structure and tables give the physical characteristics as well as the sizes in which the stock can be had. A description is given of the different uses on motor and machinery bearings. The allowable bearing pressures are listed in a table, as well as the recommended practice for oil grooving.

Belting. Chas. A. Schieren Co., 30 Ferry St., New York, N. Y., has published pages 37 to 40, inclusive, on "Why Schieren belts last longer." These pages show the methods for computation of horsepower ratings, overload capacities, center distances for open drives, and other necessary factors in belt application.

Chains. Link-Belt Co., 2045 Hunting Park Ave., Philadelphia, Pa. Book No. 755 describes the link-belt, drop forged, rivetless chain for conveyors and elevators. Photographs and drawings, as well as charts giving the sizes of the different styles, are included in its eleven pages.

Folder No. 591 describes and illustrates the design and characteristics of the Link-Belt combination chain, "C" class. Attachments to the chain are also shown.

Compressors, Air. The Pennsylvania Pump & Compressor Co., Easton, Pa., has issued bulletin No. 126 illustrating and describing the Pennsylvania duplex, single-stage and two-stage cross-compound air compressors, Class DB and DE. Its sixteen pages contain many detailed photographs and descriptions of the parts.

Controls, Remote, Electric. General Electric Co., Schenectady, N. Y. Folder EB-12, entitled "Visual Supervision for Ventilation Control" shows the advantages of remote indicating control to the operator, in a concise form.

Drills, Diamond Core. Sullivan Machinery Co., Chicago, Ill. Catalog No. 80 containing eighty 6x9-in. pages and entitled "Sullivan Diamond Core Drills" is devoted to a description and to the uses of this equipment. Many photographs are used to illustrate the text. The subjects taken up include modern prospecting, the cost of diamond drilling and a description and list of the equipment manufactured by the company. Instructions are given for the operation and setting up of the drills.

Catalog No. 80-0, containing eighty 6x9-in. pages, is entitled "Diamond Drilling for Oil with the Sullivan Diamond Core Drill." This catalog takes up the subject of diamond drilling for oil, oil field exploration and the advantages and the construction of the diamond core drills. The text is very complete and well illustrated. Much information will be found in both catalogs, of value to those interested in prospecting and its problems.

Gears, Worm. The Cleveland Worm & Gear Co., 3258 East 80th St., Cleveland, Ohio, has published bulletin No. 105, entitled "Cleveland Worms and Gears." A description is given of the gears and worm-reducing units in general, and drawings and tables show the styles and specifications of the different units. Illustrations and descriptions are given also of typical applications of the equipment of this company.

Machinery. Sullivan Machinery Co., 122 South Michigan Ave., Chicago, Ill., has published in two 6x9-in. volumes a general catalog composed of the various bulletins that it has issued. They are arranged in alphabetical order according to subjects and have thumb index tabs. The equipment taken up in part 1 include diamond drills, air lifts, furnaces and drill sharpeners, portable hoists, spaders and concrete busters, vacuum pumps and coal cutters. That in part 2 includes steam, power and portable compressors and unmounted drill hammers and piston drills and mountings. The volumes are bound in flexible cardboard with cloth backs.

Motors, Electric. The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has published motor-application circular No. 7381 entitled "Electrical Drives for Power Plant Auxiliaries." The bulletin discusses the advantages and selection of auxiliary drives, pumps, fans and blowers, as well as coal handling and pulverized fuel equipment. It describes also methods of control and the motors themselves.

Pyrometers. The Brown Instrument Co., Philadelphia, Pa., is distributing a special survey prepared by the A. C. Nielsen Co. on the Brown pyrometers used by the Westinghouse Electric & Manufacturing Co. This survey is based on the characteristics and the performance of an installation of thirty pyrometers.

Rheostats. Allen-Bradley Co., Milwaukee, Wis. Bulletin No. 410 on the type E-2100 and E-2200 controlling rheostats describes the application and the operation of the equipment. The details of construction are illustrated and systematically taken up.

Screw Machines. Brown & Sharpe Manufacturing Co., Providence, R. I. A large 8½x11-in. 140-page general catalog of its line of screw machines has been prepared by this company. The development of the screw machine and manufacturing methods, as well as general features of design, are described. The remainder of the book includes illustrations, details of construction and specifications of this company's plain, wire-feed and automatic screw machines, automatic turret forming and cutting-off machines, as well as attachments, tools and accessories. The text is well prepared and arranged.

Testing Machines, Hardness. Wilson-Maeulen Co., Inc., 383 Concord Ave., New York, N. Y. Catalog R-5, in 16 pages, describes and illustrates the various models included in its line of hardness testing machines. Diagrams are included to show the operation of the equipment.

Testing Machines, Tensile. Herman A. Holz, 17 Madison Ave., New York, N. Y. Bulletin No. 34 is a 24-page discussion of the advantages of design and construction of the Amsler tensile testing machine. Many different types and installations of the equipment are illustrated and briefly described. A description of the Amsler pendulum dynamometer is included in this catalog. This instrument is illustrated by means of drawings.

Trucks, Lift. Barrett-Cravens Co., 1328 West Monroe St., Chicago, Ill. A description of the points of construction, as well as graphic illustrations of the characteristics and capacities of the truck, are contained in bulletin No. 101. Many views are shown of the truck in use in large plants throughout the country. Two pages are devoted to platform designs made by this company.

Calendar of Local Meetings

National Association of Cost Accountants

Scranton Chapter. Jan. 19. Debatable Points in Cost Accounting.

Twin Cities Chapter. Jan. 19. Carrying Out the Budget Plan.

Syracuse Chapter. Jan. 20. Cost Analysis to Disclose Waste in Distribution.

Cleveland Chapter. Jan. 20. Inventory Methods.

Rochester Chapter. Jan. 20. Business Forecasting.

Chicago Chapter. Jan. 21. Planning for Reduced Production Costs.

Boston Chapter. Jan. 28. Accounting for Depreciation.

Buffalo Chapter. Jan. 28. Factory Overhead.

San Francisco Chapter. Jan. 28. Relation of Business Cycles to Costs and Prices.

Society of Automotive Engineers

Buffalo Section. Jan. 19. "Opportunity in Transportation for the Automotive Engineer," by J. E. Schipper.

Dayton Section. Jan. 20. "Aerial Photography," by Lieut. George Goddard.

American Society for Steel Treating

Buffalo. Jan. 21 and 22. Winter sectional meeting, Hotel Statler.

Hartford. June. Spring sectional meeting.

American Society of Mechanical Engineers

New York. Jan. 18. Domestic Heating.

Meriden. Jan. 19. Manufacturing and Management Problems.

New Britain. Jan. 21. "Advantages of Up-to-Date Machine Tool Equipment," by L. C Morrow, managing editor, *American Machinist*.

Forthcoming Meetings

American Society for Steel Treating. Winter sectional meeting, Hotel Statler, Buffalo, N. Y., Jan. 21 and 22. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Society of Automotive Engineers. Annual meeting, General Motors Bldg., Detroit, Jan. 26 to 29. Coker F. Clarkson, secretary and general manager, 29 West 39th St., New York City.

National Foreign Trade Council. Thirteenth national foreign trade convention, Charleston, S. C., April 28, 29 and 30. O. K. Davis, secretary, India House, Hanover Square, New York.

American Gear Manufacturers' Association. Tenth annual meeting, Book-Cadillac Hotel, Detroit, May 13, 14 and 15. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Supply and Machinery Manufacturers' Association. Annual convention, Hotel Statler, St. Louis, week of May 17. F. D. Mitchell, secretary, 1819 Broadway, New York.

National Association of Purchasing Agents. Eleventh annual convention and exposition, Ambassador Hotel and Auditorium, Los Angeles, Calif., June 9 to 12. W. L. Chandler, secretary, Woolworth Bldg., New York.

American Society for Testing materials. Twenty-ninth annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 21 to 25. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig-iron prices firm and unchanged from week ago levels; buying is in small lots for prompt shipment. Semi-finished steel (billets and openhearth sheet bars) advanced $1 per ton during week. Steel sheets holding firmly with no change in mill base. Steel demand indicates sustained activity in construction, automotive, agricultural implement and oil industries. Current mill prices follow: Bars, $2@$2.10; shapes and plates, $1.90@$2 per 100 lb. Pittsburgh. The minimum on plates is considerably above a week ago.

Non-Ferrous Materials — Price of antimony tending sharply upward. Lead unchanged from week ago. Wiping cloths about 1c. per lb. above Dec. 31 level. Scrap (except heavy copper and wire) firm with upward tendency in New York and Chicago.

(All prices as of Jan. 8)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.05
Northern Basic	24.27
Southern Ohio No. 2	24.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.37
BIRMINGHAM	
No. 2 Foundry	22.00@23.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.16
Virginia No. 2	29.17
Basic	23.16
CHICAGO	
No. 2 Foundry local	23.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	26.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	22.27
Basic	22.27
Bessemer	22.27

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00@5.50
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.50	3.89	3.15	3.50
No. 12	2.55	3.94	3.20	3.55
No. 14	2.60	3.99	3.25	3.60
No. 16	2.70	4.09	3.35	3.70
Black				
Nos. 18 to 20	3.15	4.15	3.75	3.90
Nos. 22 to 24	3.20	4.20	3.80	3.95
Nos. 26 and 27	3.25	4.25	3.85	4.00
No. 28	3.35	4.35	3.95	4.10
Galvanized				
No. 10	3.60	4.35	4.25	4.25
Nos. 12 to 14	3.70	4.45	4.35	4.35
No. 16	3.85	4.60	4.50	4.50
Nos. 18 to 20	4.00	4.75	4.65	4.65
Nos. 22 to 24	4.15	4.90	4.70	4.80
Nos. 26 and 27	4.30	5.05	4.95	4.95
No. 28	4.60	5.35	5.10	5.25

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded.	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded.	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameters Inches External	Diameters Inches Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness Decimal Fractions	B.W.G. and	Outside Diameter in Inches ½	⅝	¾	⅞	1	1¼	1½
		Price per Foot						
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049″	18	.17	.18	.19	.20	.21	.23	25
.065″	16	.19	.20	.21	.22	.23	.25	.27
.083″	14	.20	.22	.23	.24	.25	.27	.29
.095″	13	.21	.23	.25	.26	.27	.29	.31
.109″	12	.22	.24	.26	.27	.28	.30	.32
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33
.134″	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	7.00	6.00@7.50	4.65†
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.85	4.15
Cold rolled strip steel	6.35	6.35	6.80
Floor plates	5.55	5.60	5.50
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.10
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.40	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	50@60%	55%	60%

Electric welding wire, New York, $\frac{3}{32}$, 8.25c.; $\frac{1}{8}$, 7.85c.; $\frac{5}{32}$ to $\frac{1}{4}$, 7.35c. per lb. *Flat, $\frac{3}{16}$@$\frac{1}{4}$-in. thick. †F.o.b. cars.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.00
Tin, 5-ton lots, New York			64.00
Lead (up to carlots) E. St. Louis	9.10	New York	10.00
Zinc (up to carlots) E. St. Louis	8.75	New York	9.75

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	26.00	24.50	....
Copper sheets, base	22.50	22.50	22.75
Copper wire, base	19.62½	16.50	16.50@16.75
Copper bars, base	22.12½	21.00	22.37½
Copper tubing, base	24.50	24.50	24.75
Brass sheets, base	19.12½	18.87½	19.37½
Brass tubing, base	23.75	23.50	27.37½
Brass rods, base	16.87½	16.62½	17.12½
Brass wire, base	19.62½	19.37½	19.87½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	28@29	28.00	28.03
Zinc sheets (casks)	12.00	12.60@12.95	12.27
Solder (½ and ½), (case lots)	40.25	41.00	38@42
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade			80.62½
Commercial genuine, intermediate grade			56.00
Anti-friction metal, general service			31.50
No. 4 babbitt (f.o.b.)			14.50
Nickel, f.o.b. refinery, cents per lb.:			
Ingots 31.00	Electrolytic 38.00	Shot	32.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.12½@12.25	11.25	11.50@12.00
Copper, heavy, and wire	11.75@12.00	11.50	11.25@11.75
Copper, light, and bottoms	9.50@10.75	9.50	10.00@10.50
Heavy lead	8.00@8.50	7.50	7.75@8.25
Tea lead	6.25@6.50	5.00	6.75@7.25
Brass, heavy, yellow	7.25@7.75	7.25	7.50@8.00
Brass, heavy, red	9.50@10.00	9.50	8.75@9.25
Brass, light	6.00@6.50	6.00	7.25@7.75
No. 1 yellow rod turnings	8.50@9.00	8.00	7.75@8.25
Zinc	5.00@5.50	4.75	5.25@5.75

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$11.25	$11.45	$11.50
"A" Grade:				
IC,	14x20	8.85	9.40	9.50
	Coke Plates—Primes—Per box			
100-lb.,	14x20	6.45	6.10	7.00
	Terne Plates—Small lots, 8-lb. Coating—Per box			
IC,	14x20	7.85	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.20
Cotton waste, colored, per lb.	.10@.15½	.10	.17
Wiping cloths, washed white, per lb	.18	36.00 per M	.15½
Sal soda, per 100 lb. keg	2.25	2.25	2.75*
Roll sulphur, per 100 lb. keg	3.75	3.75	4.50
Linseed oil, per gal., 5 bbl. lots	.93¾	1.10	.99
Lard cutting oil, 25% lard, per gal.	.55	.50	.54
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.35	.35	.26
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

*In 175 lb. kegs.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.0415
Brass rods	per lb	.1687½	.1712½	.1687½
Solder (½ and ½)	per lb.	.4025	.4025	.40@.41
Cotton waste	per lb.	.15@.22	.15@.22	14@21
Washers, cast iron (¼ in.)	per 100 lb.	7.00	7.00	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.55	3.55	3.38
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.35	.35	.29
Belting, leather, medium	off list	40–5%	40%	40–2½%
Machine bolts up to 1x30 in.	off list	40%	40%	45%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.56	$5.84	$5.65
Emery paper	10.71	11.00	10.71
Emery cloth	29.48	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.45	1.49
Cloth	3.55	3.55	3.20
Fire clay, per 100 lb. bag		.60	.75
Coke, prompt furnace, Connellsville	per net ton		5.25@5.75
Coke, prompt foundry, Connellsville	per net ton		6.00@6.50
White lead, dry or in oil	100 lb. kegs		New York, 15.25
Red lead, dry	100 lb. kegs		New York, 15.25
Red lead, in oil	100 lb. kegs		New York, 16.75

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1⅛ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ½x¼-in., 2c. each. Discount 70% for $\frac{5}{16}$-in and smaller and 65% for ⅜-in. and larger.
Case hardened ½x¼-in., 6c. each, less 50%.

Rivets, button heads, ⅜-in., ½-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in. $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{1}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ⅜-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅜-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Calif., San Diego—Harbor Dept.—hoisting crane. $18,500 available.

Ill., Decatur—J. M. Espelding, 1159 North Union St. (sheet metal work)—8 ft. brake and radiator repair outfit.

Ill., Freeport—The Burgess Battery Co., Brearly St., Madison, Wis.—equipment for the manufacture of batteries for plant recently acquired. Estimated cost $40,000.

Ind., Lafayette—Lafayette Machine Co.—Ryerson friction saw, Wallace 5-H pipe bender.

Mich., Detroit—Dept. of Street Railways, St. Jean and Shoemaker Aves., F. Meyer, Jr., Purch. Agt.—4 rail grinders.

Mich., Grand Rapids—The Grand Rapids Railway Co., L. J. Demarter, Gen. Mgr.—miscellaneous shop and garage equipment.

Mich., Monroe—Detroit Stoker Co.—5 ton traveling crane to fit 37 ft. 8 in. span.

N. Y., Harrison—Manufacturers Can Co., 501 1st Ave. — power wire cutter and straightener for 8 to 14 in. gauge wire, length maximum 36 in.

N. Y., New York—Novo Tool Corp., 758 Whitlock Ave.—geared power press and Bliss filing machine.

N. Y., New York—Quality Art Novelty Co., 18 West 18th St.—surface grinder with magnetic chuck and automatic feed, No. 2.

O., Columbus—J. E. McNally Lumber Co., 1655 Snider St. (retail lumber and mill work)—J. E. McNally, Pres.—sticker, Universal woodworker, 2 cut off saws, medium size.

Pa., Uniontown—Richmond Radiator Co., 5 ton 56 span magnet handling crane.

Tex., Robstown — E. McCaskill — saws, cutters, planers, etc. for recently acquired planing mill.

Wis., Madison—R. Mitchell, 635 Williamson St.—machine tools, etc. for proposed 2 story, 50 x 150 ft. garage and repair shop. Estimated cost $50,000.

Wis., Menasha — Tayco Register Shield Co., c/o C. M. Crawford, Purch. Agt.—special machinery and equipment for the manufacture of register shields and heating devices.

Wis., Milwaukee—G. Wink, 235 Cleveland Ave. (woodworking)—24 in. self feed polisher.

Wis., Wauwatosa — R. Behling, Blue Mound and Watertown Roads (woodworking)—combination woodworker, small drill press.

Opportunities for Future Business

Calif., Eagle Rock (Los Angeles P. O.)—Bd. of Education, Los Angeles, is having plans prepared for the construction of a group of high school buildings including shops, etc., here. Estimated cost $345,000. C. M. Winslow, Van Nuys Bldg., Los Angeles, Archt.

Conn., Bristol—New Departure Mfg. Co., 269 North Main St., will soon award contract for the construction of addition to factory for the manufacture of ball bearings. Estimated cost $40,000. Lockwood Greene & Co., 24 Federal St., Boston, Archts. Noted Dec. 24.

Conn., Derby—Derby Gas & Electric Co., 22 Elizabeth St., awarded general contract for the construction of a 3 story, 41 x 85 ft. shop on Housatonic Ave. Estimated cost $50,000. R. W. Foote, 185 Church St., New Haven, Archt. Noted Jan. 7.

Conn., Meriden—Meriden Lumber Co., 174 State St., plans the construction of a 2 story, 22 x 74 ft. supply building and store house. Estimated cost $40,000. W. T. Arnold, 34½ West Main St., Archt.

Ga., Albany—C. E. Weaver, Savannah, Engr. of Maintenance of Ways, will receive bids until Jan. 25 for the construction of a 1 story roundhouse and storehouse for Central of Georgia Ry. Co. C. K. Lawrence, Savannah, Ch. Engr.

What This Section Is

Machinery Requirements and Industrial Construction is a reliable machinery market, because every item is reported first-hand by our own correspondents, scattered over the United States and Canada. These leads are verified by our men. We do not use newspaper clippings, nor do we listen to any hearsay or rumors. These sales leads are as accurate as our men can make them, and as timely as weekly publication will permit.

This market is for *American Machinist* subscribers. It covers the same machinery fields as does the paper. Here will be found inquiries for machine tools, presses, hammers, welding, forging and heat treating equipment, wood working machinery, cranes, hoists and other material handling machinery for the shop.

Here also will be found reports of proposed industrial construction, where sooner or later machinery will be needed.

Are you making the most of the opportunities listed here?

Ill., Chicago—S. S. Joy, 2001 West Pershing Road, Archt., will receive bids about March 1 for the construction of a 5 story, 60 x 150 ft. addition to furniture factory at Custer and Dominick Sts., for Zangerle & Peterson Co., 2164 Clybourn Ave. Estimated cost $145,000.

Ill., Chicago—Stromberg Motor Devices Co., 66 East 25th St., has purchased a 21 acre tract and plans the construction of a 1 and 2 story factory at South 54th Ave. and West 16th St. Estimated cost $1,500,000. W. M. Dunaing, 310 South Wabash Ave., Archt.

Ia., Newton—The Maytag Co. awarded contract for the construction of a 1 story, 190 x 280 ft. grey iron foundry. Noted June 18.

Ky., Hopkinsville — Forbes Mfg. Co. is having tentative plans prepared for the construction of a wagon plant including machine shop, etc., to replace fire loss.

Md., Baltimore—Edward Katzinger Co., 1959 North Cicero Ave., Chicago, Ill., plans the construction of a plant for the manufacture of bakers' tinware at Fleet, Eighth and Ninth Sts., here. Estimated cost $1,000,000.

Md., Baltimore—Lake Drive Garage Co., c/o G. S. Childs, 306 St. Paul St., Archt., awarded contract for the construction of a 2 story, 100 x 212 ft. garage at Madison Ave. and Whitelock St. $150,000.

Md., Sparrows Point (Baltimore P. O.)—Bethlehem Steel Co., Bethlehem, Pa., plans the construction of a 1 and 2 story pipe mill. Estimated cost $10,000,000. Private plans.

Mass., Worcester—Mack Motor Truck Co., 195 Massachusetts Ave., Boston, plans the construction of a garage and repair shop on Shrewsbury St. here. Estimated cost $100,000. Warren Engineering Co., Terminal Wharf, Charleston, Archts. and Engrs.

Mich., Benton Harbor—The Benton Harbor Malleable Foundry, will build a drop forge shop and extension to core room. Estimated cost $7,000 and $15,000 respectively.

Mich., Detroit—Hudson Motor Car Co., 12601 East Jefferson Ave., plans the construction of a 1 story, 150 x 340 ft. addition to building C. on Waterloo St. Estimated cost $75,000. A. Kahn, 1000 Marquette Bldg., Archt. Noted Oct. 29.

Minn., St. Paul—Twin City Rapid Transit Co., 533 Wabasha St., plans the construction of a garage at Third and St. Peter Sts. Estimated cost $500,000. Private plans.

Miss., Columbus—F. M. Jacobs, College and Sixth Sts., plans the construction of a machine shop to replace fire loss. Estimated cost $25,000.

N. J., Jersey City—Brady Brass Co., 14th and Henderson Sts., awarded contract for the construction of a 2 story addition to plant on 14th St. Estimated cost $55,000.

N. Y., Olean — Pennsylvania R.R. Co., Broad St. Station, Philadelphia, Pa., is having plans prepared for the construction of a 1 story, 110 x 175 ft. addition to car shops here. Estimated cost $215,000. W. H. Cookman, Broad St. Station, Philadelphia, Pa., Archt. R. M. Trimble, Pennsylvania Station, Pittsburgh, Pa., Asst. Engr.

O., Cleveland—W. S. Tyler Co., C. Zimmerman, Secy. and Treas., 3613 Superior Ave. (ornamental iron and bronze work) had plans prepared for the construction of a 6 story, 82 x 118 ft. factory. Estimated cost $300,000. G. S. Rider Co., Century Bldg., Archt.

O., Dayton—Duro Pump & Mfg. Co., 537 East Monument Ave., awarded contract for the construction of a 2 story, 60 x 120 ft. factory on Monument Ave. Estimated cost $175,000.

O., Toledo—Champion Spark Plug Co., R. A. Stranahan, Pres., plans the construction of a 6 story building as addition to main plant to increase the capacity.

Pa., Pittsburgh—Lustro-Coated Sheet Co., 1312 Sheffield St., is having plans prepared for the construction of a 1 story, 100 x 200 ft. plant for the manufacture of nickel and copper plated steel on Ridge Ave. Estimated cost $50,000. Private plans.

Tex., San Antonio—Unit Mfg. Co., 204 Pereida St., c/o H. E. Dickinson, Russell Bldg., plans the construction of a plant for the manufacture of gas floor furnaces, basement gas furnaces and gas heating appliances. Estimated cost $50,000.

Wis., Madison—The Way Building Co., c/o W. Way, 20 North Orchard St., plans the construction of woodworking plant. Estimated cost $40,000. Architect not selected.